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THIS EFFORT INVOLVED AN EXAMINATION OF BASIC, GROSS MOTOR SKILLS IN A VARIETY OF SPORTS ACTIVITIES THROUGH FACTOR ANALYTIC TECHNIQUES. THREE ALTERNATE SETS OF MOVEMENT FACTOR PATTERNS WERE HYPOTHESIZED ON THE BASIS OF A LOGICAL "OPINION" ANALYSIS. PATTERN "A" REPRESENTED AN OBVIOUS "OPINION" CLASSIFICATION OF THE VARIABLE BY EXTREMITIES USED IN PROJECTION. PATTERN "B" INVOLVED A MORE COMPLICATED CLASSIFICATION OF SKILLS, INCLUDING OVERARM, SIDEARM, UNDERARM, PUSHING, AND STRIKING MOVEMENTS. PATTERN "C" WAS BASED IN PART ON TWO TYPES OF PROJECTION--STRIKING AND RELEASING. THE DATA WERE GATHERED OVER A 3-MONTH PERIOD. SUBJECTS WERE APPROXIMATELY 170 JUNIOR AND SENIOR HIGH SCHOOL FEMALE STUDENTS. THEY WERE TESTED ON 25 VARIABLES, ALL OF WHICH WERE MEASURES OF ALL-OUT PERFORMANCE. EXAMINATION OF THE RESULTS INDICATED THAT THE ORIGINAL, HYPOTHESIZED SETS WERE AN INADEQUATE REPRESENTATION OF THE SKILLS IN QUESTION. THE ACTUAL FACTOR PATTERNS WERE ALMOST TOTALLY UNLIKE THE HYPOTHESIZED FACTOR PATTERNS. (HB)

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THE STRUCTURE
OF
GROSS MOTOR SKILL PATTERNS

Cooperative Research Project No. S-397

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Madison, Wisconsin

1966

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PROBLEM

The purpose of this study was to examine basic skills in a variety of sports activities through factor analytic techniques. The skills examined comprise one aspect of the domain of physical proficiency.

The outcomes of the proposed study may open the way for studies of transfer of learning in the area of gross motor skills. If certain basic motor skills are factorially similar, it would then be appropriate to study the extent to which development of proficiency in one skill would transfer to another.

OBJECTIVES

Three alternate sets of factors were hypothesized on the basis of a logical a priori analysis. Derived factor analytic solutions will be examined to determine which of these three alternate sets represents the way in which these motor skills tests function.

At least three tests were selected and/or constructed to measure each hypothesized factor. Chart A on page 3 represents the logical, a priori analysis. The columns of the chart represent the three possible sets.

Pattern A. Pattern A represents an obvious a priori classification of the variables by the extremity used in the projection. This pattern is a very simple, yet possible breakdown into a single arm factor, a two-arm factor, and a two-leg factor. These skills might be described as gross patterns of skill. Factor I Projection Using Single Arm would identified by tests which measure the ability to forcefully project an object with one hand. Factor II Projection Using Two Arms would be defined by tests which measure the same ability, using two hands. Tests of kicking skill are included as measures of the potential Factor III Projection Using Legs.

Pattern B. Pattern B involves a more complicated classification of skill. The four arm patterns are similar in that all are unilateral projections. In addition, all involve trunk rotation. The primary difference among these patterns lies in the way in which the arm is used. The overarm pattern involves medial rotation of the humerus, extension of the elbow, and flexion of the wrist. The underarm pattern

CHART A

ANALYSIS OF GROSS MOTOR SKILL PATTERNS

Test	Pattern A			Pattern B					Pattern C		
	Arms		Legs	Overarm Pattern	Underarm Pattern	Sidearm Pattern	Push Pattern	Kick Pattern	Strike	Release	Repeated Movements
	One	Two									
# 1*	X			X						X	
# 2	X			X						X	
# 3	X			X					X		
# 4	X			X					X		
# 5	X			X					X		
# 6	X				X					X	
# 7	X				X					X	
# 8	X				X				X		
# 9	X				X				X		
#10	X					X			X		
#11	X					X			X		
#12	X						X			X	
#13	X						X			X	
#14		X					X			X	
#15		X		X						X	
#16		X					X		X		
#17		X		X					X		
#18		X			X				X		
#19		X			X					X	
#20		X					X				X
#21	X						X				X
#22		X					X				X
#23			X					X	X		
#24			X					X	X		
#25			X					X	X		

* See key on following page.

Key

- # 1 Softball Overarm
- # 2 Basketball Overarm
- # 3 Volleyball Overarm Serve
- # 4 Tennis Serve
- # 5 Badminton Clear
- # 6 Bowling
- # 7 Softball Underarm
- # 8 Volleyball Underarm Serve
- # 9 Badminton Serve
- #10 Tennis Drive
- #11 Volleyball Sidearm Serve
- #12 Basketball One-Hand Push Pass
- #13 Basketball One-Hand Push Shot
- #14 Basketball Chest Pass
- #15 Basketball Overhead Pass
- #16 Volleyball Chest Pass
- #17 Volleyball Overhead Pass
- #18 Hockey Drive
- #19 Basketball Underarm Pass
- #20 Wall Volley
- #21 Bounce-dribble
- #22 Basketball Throw and Catch
- #23 Soccer Place-kick
- #24 Soccer Punt
- #25 Soccer Pass

involves shoulder flexion and wrist flexion. The sidearm pattern involves horizontal flexion-adduction of the upper arm and adduction or flexion of the wrist. These three patterns are characterized by striking and throwing projections. Factor I Overarm Pattern would be identified by tests which measure the ability to forcefully project an object with one hand, using an overarm pattern. Factor II Underarm Pattern would be defined by tests measuring the above ability using an underarm pattern. Factor III Sidearm Pattern would be defined by tests measuring the same ability, using a sidearm pattern. The fourth arm pattern is the push pattern, involving shoulder flexion, elbow extension, and wrist flexion. Factor IV Push Pattern would be defined by tests which measure the ability to project an object by pushing, using one or two hands. Factor V Kicking Pattern would be defined by tests which measure the projection of an object by kicking with the instep of the foot or with the top of the instep of the foot.

Pattern C. The breakdown of Pattern C is based in part on two types of projections, striking and releasing. These two types are all-inclusive, since striking includes kicking and releasing includes throwing and pushing. In addition, this breakdown separates projections involving a single execution from those involving repeated movements. Factor I Projection of Object by Striking would be defined by tests measuring the ability to forcefully project an object by throwing or pushing. Factor Projection of Object by Releasing would be identified by tests measuring the ability to forcefully project an object by throwing or pushing. Factor III Repeated Movements would be identified by tests which measure the projection of an object by striking or pushing in repeated movements.

RELATED RESEARCH

Most of the research on patterns of movement has been directed to the period of infancy and early childhood. The acquisition of fundamental movement patterns is dependent on the maturation of the neuromuscular system. The evidence from studies of human and animal development indicated that the emergence of basic movement patterns follows an orderly sequence during the early period of development (4, 9, 31). Efforts to speed up the appearance of these phylogenetic traits through training have met with little success (25). Thus, there are 'critical' periods in development when a particular neuromuscular skill is most susceptible to modification. Studies of the effect of deprivation of opportunity at the time the skill would normally be acquired also provided evidence of a 'critical' period in the learning of basic gross motor skills (6, 36). Unfortunately, the acquisition of gross motor skills during the school years has received little attention. Wild (35) and Dusenberry (7) have presented some evidence on the optimum time for attaining mature patterns in certain sports skills, but whether the components of a skill are similar enough with those of others to facilitate the learning of these skills is unknown.

Patterns of action are developed by the human motor mechanism which are fundamentally similar within the group but which are likely to have individual variations in detail (10). "The neurons which make up the nervous system of an adult man are ... arranged in a system the outlines of which have been shaped by the experiences of the individual" (29, p. 100). In the area of learning, a key question regarding skills which appear to be basically similar is that of transfer of learning. Some psybhologists have felt that the amount of transfer of learning from one skill to another is a function of the extent to which there are similar elements in the two skills (17, 25). The greater the similarity among skills, the greater the transfer. Physical educators have generally hypothesized that there are basic patterns of movement common to many activities (2, 5, 24, 33).

One primary intent of many foundation courses in physical education has been to teach skills basic to all movement as well as an understanding of the relevant mechanical principles of movement. If this objective can be achieved, learning a general underarm pattern and understanding the principles underlying this pattern will facilitate learning a specific skill using this pattern, such as the bowling swing. However, the grouping of various skills into patterns has largely been done on a logical basis. Occasionally, some reference has been made to the similarity of the mechanics of the grouped skills or to the establishment of a neural pathway for a group of skills. Both kinesiology and neurology have great potential for contributing to the understanding of skills and their relationships to one another. However, these areas are largely unexplored, possibly due to the complexities involved in studying gross motor skills.

One approach to the study of any domain is through factor analysis procedures. One aspect of the domain of physical proficiency, commonly called physical fitness, has been examined in this way (8,28). Other investigators (1,22,23) have explored other aspects of proficiency in addition to physical fitness. The work of these investigators has touched only briefly on the groupings of basic skills. Since this study is confined to patterns of skill in the projection of objects, other types of motor skill patterns will not be considered in the following review.

Benson (1), Liba (22), and Liba and Harris (23) have directly attacked the question of the overarm pattern. Benson (1) extracted a factor which she called 'unilateral motor patterns (other than kick) involving forceful projections of an object'. Selected tests were measures of balance, kinesthesis, and unilateral projections. Three types of skills, all overarm patterns, loaded on this factor: throwing, striking with hand, and striking with racket. Essentially the same factor was obtained with the incomplete component analysis and the incomplete image analysis. Liba's data (22) included measures of unilateral and bilateral patterns, including overarm throws, volleyball wall volley, Edgren ball handling, and basketball dribble. All these measures loaded on the same factor in three solutions:

principal component, image analysis, and Alpha factor analysis. With a fourth solution, that of Joreskog, these items formed two factors. One factor included the unilateral overarm throws. A second included the various bilateral patterns. Liba and Harris (23) included four measures of the overarm pattern when applying more recent factor analytic techniques to measures of strength. These measures included two throws, one striking with hand, and one striking with racket. For the three solutions - Alpha oblique, Joreskog oblique, and Joreskog orthogonal - the throws and striking with hand were grouped under the same factor. The Alpha oblique included the tennis serve with the other three items, while the serve loaded on a separate factor in the Joreskog oblique solution. The tennis serve had no high loadings in the Joreskog orthogonal.

Two studies yielded information about the overarm pattern, although not by the direct intent of the investigators. Ponthieux and Barker (28) factored the AAHPER Fitness Battery and identified one factor which was defined by a test of the softball throw. In a study of the nature of physical proficiency tests, Brogden (3) identified a factor labeled 'ability to mobilize quickly a maximum of force or speed'. The measures that defined this factor were softball throw, basketball throw, medicine ball put, and medicine ball throw.

In summary, the existence of basic movement patterns has been established in the literature. In general, these patterns are acquired in an orderly sequence, and can be most effectively modified at 'critical' periods in the development of the individual. Little attention has been given to patterns of gross motor skills involving the projection of objects. The survey of related literature yielded evidence of the existence of at least one motor skill pattern, the overarm pattern. In addition, the survey indicated the possibility of other patterns which might exist.

PROCEDURES

The procedures relevant to the collection of data will be presented in this section. The three major categories to be discussed are subjects, organization for test administration, and description of tests.

Subjects

The subjects were 166 junior and senior female students at Brown Deer High School in Brown Deer, Wisconsin. The group constituted nearly all of the total population of junior and senior girls at Brown Deer. The total population consisted of three classes of junior girls and three classes of senior girls. Five of these classes were selected for the study. All of these five were taught by the same instructor, and the curriculum consisted of a recreational sports unit over the period of time designated for the testing program. The one class of senior girls which was eliminated did not fit the above criteria, and in addition was scheduled at the same time as one of the other classes.

The original group contained 201 girls. However, five girls had medical excuses from physical education, and were only attending health classes. Twenty-eight girls were dropped during the last two weeks of testing. Some of these girls had so many absences over the testing period that it was impossible to make-up all the tests they had missed. Most were absent on the last day of testing, which was a make-up period. These girls were dropped due to incomplete data. By mistake, two girls were not tested on a few items, and thus were dropped because of incomplete data. The sample used in this study consisted of 166 girls. The breakdown by classes was: Period I-Juniors, 33; Period II-Seniors, 34; Period IV-Juniors, 34; Period V-Seniors, 31; and, Period VI-Juniors, 34.

Organization for Test Administration

The data were gathered over a three-month period beginning in February, 1966 and ending in April, 1966. The tests were administered in a gymnasium in Brown Deer High School, or in a balcony adjacent to that gymnasium, depending on the area to which the classes in the group were assigned.

Time schedule for test administration. The testing program was scheduled for two days a week, five periods a day. The testing periods were the regularly scheduled physical education class periods for the students. The five testing periods within a testing day occurred at the following times: Period I, 7:45-8:45; Period II, 8:49-9:44; Period IV, 10:47-11:42; Period V, 11:46-12:41; and, Period VI, 1:13-2:07. On rare occasions, fewer than five classes were tested on one day because of such events as school trips or assemblies. However, toward the end of the testing program, certain classes were tested during periods other than the regularly scheduled testing periods.

No more than two tests were completed per testing period. However, some subjects might be tested on four items on one day. The amount of testing done in any one period was determined by the number of subjects present, the difficulty of the test, and the number of trials for the test. For example, two throwing items (four trials each) could be administered by one test administrator within one class period. On the other hand, one striking item (eight trials) involving a suspended ball would necessitate a time allotment of two testing days per class for one tester.

Test administrators. The testing staff consisted of two college students and fifteen high school students. In addition, the girls' physical education teacher assisted in many phases of the testing program. The investigator remained free of assigned duties so as to generally supervise the test administration. The college students were the timers for all tests. Neither of these two girls had had any previous experience with stopwatch timing. The investigator taught these girls the basics of stopwatch timing. Then, a week before the testing program began, the timers practiced timing the speed of the bowling ball, since bowling was the first skill to be tested. On the first day of the testing program the timers again practiced using the stopwatches before beginning to administer the tests. In general, one timer tested all subjects on any one variable, rather than both timers testing the same variable. During the two weeks of make-up testing, this division of labor was not always possible, since a timer might conceivably test two girls on a skill which, in the past, had been the responsibility of the other timer. This situation occurred, although infrequently, because one timer had a heavier make-up load than the other timer.

In addition to training the timers to use stopwatches, the purpose of the testing program and the nature of the tests were explained to them. Then, at the beginning of every testing day, new tests were carefully explained and demonstrated to the timers. They then practiced performing the skill, as well as timing the skill. Practice in the performance of the skill was beneficial, since it seemed to help them interpret the skill to the students.

Ten of the high school girls served as scorers. Two scorers were needed each hour, one for each timer. Each scorer worked with the same timer throughout the testing period. Scoring procedures were explained in detail the week before the testing program began. The five remaining high school girls handled the suspension equipment when such equipment was in use.

Preparation for test administration. During the week previous to the beginning of the testing program, the physical education teacher presented an overall picture of this study to all five classes. On the first day of testing, the investigator discussed the nature of the tests with all the subjects. Two points were emphasized: (1) that the test items required all-out effort on the part of the subjects, and (2) that each student would be capable of performing every test item.

The explanation of each new test was carried out by either the physical education teacher or the investigator. This explanation was always followed by a demonstration of the skill by one of the timers, the physical education teacher, or the investigator. The instructions for #15 Basketball Overhead Pass will be used to illustrate the demonstration-explanation.

> In this test, we want to know how fast you can throw a basketball from behind this line (point to restraining line) to the wall. You must use two hands to throw the ball. Also, the ball must be thrown from an overhead position - like this (demonstrate). It does not matter whether you have played basketball before. Simply throw the ball as fast as you can. You may take a step forward as you throw the ball, as long as you remain in back of the restraining line. Remember that we are interested in how fast you can throw the ball.

The subjects were given a practice period before being tested. The number of practice trials was flexible, depending on the needs of the subjects. For example, one subject might have difficulty performing the item correctly, and thus need more practice than a girl who could perform the skill properly. The practice trials were conducted by the physical education teacher and the investigator.

Description of the Tests

The study was originally designed to test twenty-eight variables. Four test items were dropped during the testing period, add one item was added. The tests which were omitted were Basketball One-Hand Bounce Pass, Basketball Two-Hand Bounce Pass, Golf Drive, and Batting. The two Bounce Pass items were dropped due to the length of time necessary for the administration of these tests. The measurement devices for the Golf Drive and Batting were poor. The golf device did not differentiate between girls who were good golfers and girls who had never plaved golf. Also, it became apparent that most subjects had not had adequate experience with this skill, and that the process of familiarizing them with the skill would have been excessively time-consuming. Although most subjects could contact a suspended ball in the batting test, the majority had great difficulty hitting an aerial ball. Again, obtaining velocity scores for this test would have taken an excessive amount of time. The Basketball One-Hand Push Shot was added to the remaining tests, making a total of twenty-five items. The latter test was included because it utilized a wall height restriction, a characteristic of only one other test, #16 Volleyball Chest Pass. Although all of the items measured all-out ability, there were three types of scores. These types were velocity scores, time scores, and number of repetitions. Velocity scores were used in all but five cases. Time scores were used for #18 Hockey Drive and

#6 Bowling. Obviously, time scores were a satisfactory representation of force when the object was projected on the ground or floor, because it was not necessary to be concerned with the effect of gravity and the angle of projection. The scores which represented the number of repetitions were used for #20 Wall Volley, #21 Bounce-dribble, and #23 Basketball Throw and Catch.

Since there were certain elements common to all tests which were scored in the same way, the tests were grouped by the type of scores which were yielded. In this way, summary statements could be made about each group of tests, followed by a brief description of each test. It should be noted that this grouping was merely for convenience in describing the tests, and was in no way related to the hypotheses about the tests. A detailed description of each test is included in Appendix A.

Tests yielding velocity scores. In this study, velocity scores were determined by four variables: three dependent and one independent. The three dependent variables were wall height, time, and height of contact or release. Distance was the independent variable. The wall height was measured on a grid of lines placed one foot apart on the wall. Numbers representing feet from the floor were placed between the lines. A projectile landing on the line was scored by the number above the line. The time was measured to the nearest hundredth of a second using a fast stopwatch. The contact or release height was the height at which the subject actually contacted or released the projectile. This variable was measured for a small group of subjects of varying heights for any given test, and estimated for the total sample based on the student's height and the length of the implement used, if any. The horizontal distance was the number of feet over which the object was projected by the subjects. The velocity scores were obtained from tables which are described in Appendix A.

#1 Overarm Softball Throw measured the ability to forcefully project a softball using an overarm throw, with four trials taken at a distance of thirty feet from the wall.

#2 Overarm Basketball Throw measured the ability to forcefully project a basketball using an overarm movement, with four trials taken at a distance of twenty feet from the wall.

#3 Overarm Volleyball Serve measured the ability to forcefully project a volleyball with one hand, using an overarm movement, with eight trials taken at a distance of fifteen feet from the wall.

#4 Tennis Serve measured the ability to forcefully project a tennis ball with a tennis racket, using an overarm movement, with eight trials taken at a distance of thirty feet from the wall.

#5 Badminton Clear measured the ability to forcefully project a cork ball with a squash racket, using an overarm movement, with eight trials taken at a distance of forty feet from the wall.

#7 Softball Underarm Throw measured the ability to forcefully project a softball with an underarm swing, with four trials taken at a distance of thirty feet from the wall.

#8 Volleyball Underarm Serve measured the ability to forcefully project a volleyball using an underarm swing, with six trials taken at a distance of thirty feet from the wall.

#9 Badminton Underarm Serve measured the ability to forcefully project a cork ball with a squash racket, using an underarm movement, with six trials taken at a distance of thirty feet from the wall.

#10 Tennis Drive measured the ability to forcefully project a tennis ball with a tennis racket, using a sidearm movement, with eight trials taken at a distance of thirty feet from the wall.

#11 Volleyball Sidearm Serve measured the ability to forcefully project a volleyball, by striking it with the hand, using a sidearm swing, with eight trials taken at a distance of fifteen feet from the wall.

#12 Basketball One-Hand Push Pass measured the ability to forcefully project a basketball against the wall by pushing the ball with one hand, with six trials taken at a distance of fifteen feet from the wall.

#13 Basketball One-Hand Push Shot measured the ability to forcefully project a basketball on or above the 10' wall area by pushing the ball with one hand, with six trials taken at a distance of fifteen feet from the wall.

#14 Basketball Two-Hand Chest Pass measured the ability to forcefully project a basketball by pushing the ball with two hands, with six trials taken at a distance of fifteen feet from the wall.

#15 Basketball Overhead Pass measured the ability to forcefully project a basketball by releasing the ball from an overhead position, using two hands, with six trials taken at a distance of twenty feet from the wall.

#16 Volleyball Chest Pass measured the ability to forcefully project a volleyball on or above the 9' wall area, using two hands to strike the ball, with six trials taken at a distance of fifteen feet from the wall.

#17 Volleyball Overhead Pass measured the ability to forcefully project a volleyball from an overhead position, striking it with two hands, with six trials taken at a distance of fifteen feet from the wall.

#19 Basketball Underarm Pass measured the ability to forcefully project a basketball by throwing with two hands, using an underarm swing, with six trials taken at a distance of twenty feet from the wall.

#23 Soccer Place-kick measured the ability to forcefully project a soccer ball by kicking the ball from a stationary position, using one foot, with six trials taken at a distance of thirty feet from the wall.

#24 Soccer Punt measured the ability to forcefully project a soccer ball by punting it, with six trials taken at a distance of thirty feet from the wall.

#25 Soccer Pass measured the ability to forcefully project a soccer ball using the instep of the foot, with six trials taken at a distance of thirty feet from the wall.

Tests yielding time scores. When the projectile remained on the floor and the distance was held constant, time scores were adequate representations of the force component of the skill. In this case, only one independent variable, time to the nearest hundredth of a seoond, needed be obtained.

#6 Bowling measured the ability to forcefully project a bowling ball using an underarm swing, with four trials taken at a distance of sixty feet.

#8 Hockey Drive measured the ability to forcefully project a hockey ball using a hockey stick, with six trials taken at a distance of twenty feet from the wall.

Tests yielding numbers of repetitions. The basic characteristic of these three tests was that, within a given time limit, the subjects were asked to repeatedly execute a skill as many times as possible. The score was the number of satisfactory executions within the time period.

#20 Wall Volley measured the ability to project a volleyball against the wall repeatedly, using two hands, with three trials of thirty seconds each.
#21 Bounce-dribble measured the ability to project a basketball repeatedly against the floor, using one hand, with four trials of five seconds each.
#22 Basketball Throw and Catch measured the ability to forcefully project a basketball repeatedly against a wall by releasing and catching with two hands, with four trials of thirty seconds each.

ANALYSIS OF THE DATA

The data from a set of observed variables can be factored in a number of ways. One cannot, in general, say that one solution is best. Often, an a priori notion of the factorial nature of the data is formed. For example, one might formulate a theory and attempt to verify it by some factorial solution. Spearman's theory of general mental ability led to the development of his Two-Factor theory (32). Thurstone's idea of primary mental abilities could most logically be studied through a model which handled overlapping group factors (34). On the other hand, the methods of factor analysis may lead to the development of some theory. When many tests exist in a particular area, which are not clearly defined in terms of relationships, factorial procedures can yield a parsimonious description of the data. For example, Fleishman factored a large number of strength tests in order to more clearly define the construct of strength (8).

Two broad categories of multivariate analysis, component analysis and factor analysis, will be discussed in this section. In addition, derived solutions will be commented on.

Component Analysis

A component analysis is carried out with the test space, the area which is defined by the observed variables. The primary objective in component analysis is to account for as much of the total variance as possible. When the observed data are reduced to R, a correlation matrix with units in the diagonals, the complete set of components (or factors) of R can be developed by some computing algorithm. When this algorithm is a principle axis transformation, the solution is known as a principal components solution of R. If, on the other hand, the observed data are linearly transformed to the form of $(I - S^2R^{-1})Z'$, the analysis on the transformation is known as image analysis. All complete component analyses yield two matrices: a factor matrix (F) and a matrix of component (or factor) scores.

Complete Principal Components Model. In the principal components model (Hotelling, 1933), one begins with the correlation matrix R and extracts successive components. The factors are represented by the principal axes of the ellipsoids. The first general factor accounts for a maximum amount of the possible variance. The second factor accounts for a maximum in the residual space with the first factor removed; and so on, until the last common factor accounts for whatever communality remains. This model yields a number of factors equal to the number of observed variables.

When the data are reduced to a correlation matrix, the observed scores for the variables are scaled so that each variable has unit variance. If the data were rescaled into some form other than the correlation matrix R, the principal components model would yield a solution that is not related in any simple way to the solution obtained from R. In other words, the principal components analysis is not scale-free. This is a disadvantage of this model.

Incomplete Principal Components Analysis. The purpose of using an incomplete principal components analysis over the complete analysis is that the factors accounting for only a small protion of the variance are discarded. The incomplete solution yields, for the first n factors extracted, the same factor scores as the complete solution and factor loadings that are proportional to those obtained in the complete solution.

Complete Image Analysis. According to Guttman's theory (11), any measurement can be represented by two independent parts: the image and the anti-image. The image of a variable can be predicted from the remaining n-1 variables. The anti-image is the unpredictable part.

By geometric description, the image is represented by the projection of a variable into the subspace of the remaining n-1 variables. The anti-image is orthogonal to the image projection. The cosine of the angle between the variable and its respective projection is the multiple correlation coefficient of that variable with the remaining variables. The square of the multiple correlation (smc) represents the portion of the total variance that is dependent on the remaining n-1 variables.

Image analysis is scale-free; therefore, the image matrix can be developed from R in the following way:

$$G = R + S^2R^{-1}S^2 - 2S^2,$$ where G is the image variance-covariance matrix, R is the correlation matrix with units in the diagonals, and S^2 is a diagonal matrix for which the diagonals, s_j^2, are the reciprocals of the diagonals of R^{-1}. The square of the multiple correlation of any variable, j, with the remaining set is represented by $1 - s_j^2$. The matrix G has these squared multiple correlations in the diagonals. This matrix can be factored completely, giving as many factors as variables.

Incomplete Image Analysis. An incomplete image analysis extracts m factors, m representing Guttman's strong lower bound. Incomplete image, then, discards some factors which are extracted by complete image analysis.

As an alternative to incomplete image analysis, $R-S^2$, a correlation matrix with squared multiple correlations in the diagonals, can be factored (14). The first m factors of $R-S^2$ will be proportional to the first m factors of G. Furthermore, the least squares estimates of the factor scores for $R-S^2$ are identical to the computed factor scores of G.

Factor Analysis

Consider the variables representing the observed data as vectors which are embedded in a space which can be called the test space. The test space is embedded in a space made up of vectors which represent the individuals on whom the observations were made. The latter space can be called the person space. Factor analysis can then be defined as taking place in the common-factor space, which is in the person space but outside the test space.

The primary concern in factor analysis is to yield a factor matrix which best fits the correlation matrix. The factor analysis models discussed in this paper have the advantage of being scale-free. The factor scores, however, cannot be computed precisely with these models, but can only be estimated.

Rao's Canonical Factor Analysis. The Rao model is similar to Lawley's maximum likelihood solution, where the number of factors can be determined by statistical test. The canonical model for factor analysis involves the derivation of uncorrelated common factors which have the maximal canonical correlations with the observed variables (30).

The equation for this model is $R - bU^2 = 0$, where R is a correlation matrix with unities in the diagonals, U^2 is an unknown matrix of unique variances, and b represents the roots. The unique variances are estimated and then the roots are solved for, under the restriction of a hypothesized number of common factors. If the hypothesized number of factors is rejected by this test, one additional factor is postulated and the process is begun again.

Since the number of common factors is determined by statistical test, this number may be a function of the size of the sample of individuals tested, rather than a function of the number of variables measured (14). Harris (13) proposed a variant of the Rao solution. Guttman's best lower bound (smc) is used to determine the minimum number of factors, rather than using Rao's statistical test. However, the form of Rao's solution is retained. "This variant of Rao by way of Harris rescales the variables in the metric of the unique portion of the data, analyzes the rescaled data, and then transforms the results back into the original metric of the variables if that is desired, or into any other metric one wants, such as the equal-variance metric associated with standard scores" (13, p11) Thus, through the Harris-Rao-Guttman solution, the number of common factors is determined by Guttman's strong lower bound, but any factor not significant by Rao's statistical test is discarded.

Alpha Factor Analysis. Through the application of canonical factor analysis, certain statistical inferences can be made. In other words, certain inferences can be made about a population of individuals from the characteristics of a random sample of individuals. Alpha factor analysis (21), on the other hand, allows one to make inferences about a population of variables from a nonrandom sample of variables. This type of inference is psychometric inference.

With Alpha factor analysis, the variables are rescaled in the metric of the common portions of the data. Canonical factor analysis rescales in the unique portions of the data. Alpha factor analysis, like canonical, is scale-free.

The rule for the number of common factors is a psychometrically oriented one. "... if a common factor has non-positive generalizability (if its associated eigenvalue is less than or equal to one), one may appropriately reject it" (21, p. 11). Thus, the factors that can be generalized to a universe of variables are retained. As the number of canonical factors retained is a function of N, so the number of Alpha factors is a function of n, the number of observed variables.

Joreskog's Factor Analysis. In the Joreskog model, the parameters may be estimated and tested statistically without the use of iterative techniques. In addition, this model makes an assumption about the residual variances which eliminates the communality problem. This restriction is "that the residual variances are proportional to the reciprocal values of the diagonal elements of the inverted population dispersion matrix" (18, p. 11).

According to Joreskog, Lawley's general maximum likelihood solution is more efficient than the above model. However, the Lawley method is iterative, and thus involves an enormous amount of computations. Thus, the primary value of the Joreskog solution lies in the fact that it closely approximates the Lawley solution. The Joreskog method determines the loading estimates directly without the use of iterative techniques.

Derived Solutions

An initial solution is rotated to obtain a more meaningful interpretation of the data. This rotation yields a derived solution, which may be either orthogonal or oblique. In the orthogonal solution, the axes are kept at right angles. The factors are kept orthogonal or independent, uncorrelated with one another. With an oblique solution, the factors are related. An oblique solution yields three matrices: (1) A pattern matrix of coefficients (factor loadings) derived from parallel projections onto the factors, (2) A structure matrix of correlations between variables and factors based on perpendicular projections onto the factors, and (3) A matrix of the intercorrelations among elements. In an orthogonal solution, the perpendicular and parallel projections are the same, i.e., the pattern is equal to the structure.

The problem of orthogonal rotation has been adequately solved for some time (12, 14). Several analytic methods of orthogonal rotation are available, such as quartimax, raw varimax, equamax, and normal varimax. However, normal varimax is often preferred since this is the only rotational procedure that will not destroy the scale-free feature of an initial solution (14).

Recently, a general model has been built for all solutions, orthogonal and oblique (15). By using this general model, an initial orthogonal solution is rescaled and rotated by some analytic orthogonal rotation, to obtain an oblique solution. Harris-Kaiser have found that there are two mutually exclusive classes of oblique solutions. One of these subclasses is appropriate when the common factor portions of a particular set of variables can be expressed as a set of independent clusters.

Even more recently, Kaiser has developed a derived oblique solution which, for some sets of data, will yield a pattern matrix with a larger number of zero elements than the oblique independent cluster solution. This procedure is called Winsorizing. At the present time, no literature is available on this technique.

Specifications of Four Factor Models

The four factor models used in this study have been examined extensively in a recent study (16). The descriptions of these models will be given in this section exactly as presented in the Harris-Liba study.

"The methods of developing an initial solution will be described in matrix notation. First we establish these four definitions:

R The observed correlation matrix with units in the main diagonal, of order p-by-p.

F An initial factor (or component) matrix. The definition of F depends upon the model and is made explicit below for each of the models considered here. F always has p rows;

the number of its columns equals the number of factors (or components) extracted.

S^2 A diagonal matrix of order p-by-p, with non-zero entries each equal to the reciprocal of the corresponding element of R^{-1}. Thus, $I-S^2$ is a diagonal matrix of squared multiple correlations of each variable with the remaining p-1 variables.

H^2 A diagonal matrix of order p-by-p, whose non-zero entries are the communalities. For Models A and D, H^2 is computed after the fact and does not enter into the initial determination of the factors (or components). For Model B the first stage is one of selecting trial communality values and converging these to reasonably stable values under a restriction on the number of factors. Model C, $U^2 = I - H^2$ is taken as proportional to S^2.

Next, we define the four models employed in terms of these definitions as:

Model A This is an incomplete principal components solution of R. The criterion for the number of components to extract is Guttman's "weak" lower bound to the number of common factors (Guttman, 1954). This is the number of eigenvalues of R that exceed unity. For this model, $F = QD$, where Q designated orthonormal columns of eigenvectors of the matrix R, and D is a diagonal matrix of the positive square roots of the eigenvalues greater than unity of this same matrix.

Model B This is alpha factor analysis (Kaiser and Caffrey, 1965). $F = HQD$, where H is defined as above, Q designates orthonormal columns of eigenvectors of the matrix $H^{-1}(R - U^2)H^{-1}$, and D is a diagonal matrix of positive square roots of the eigenvalues greater than unity of this same matrix. The F for Model B has the same number of columns as does the F for Model A.

Model C This is Joreskog's procedure (1963), which determines a constant, t, on the basis of a statistical test and then takes $U^2 = I - H^2$ as tS^2. The number of factors is also determined by the statistical test. The factor matrix is given by $F = SQD$, where S is as defined above, Q designates orthonormal columns of eigenvectors of $S^{-1}RS^{-1}$, and D is a diagonal matrix of positive square roots of the eigenvalues of $S^{-1}RS^{-1}-tI$. Model C has certain correspondences with Model D.

Model D This is related to Guttman's image theory (Guttman, 1953; Harris, 1962; Kaiser, 1963). $F = SQD$, where S is as defined above, Q designates orthonormal columns of eigenvectors of the matrix $S^{-1}RS^{-1}$, and D is a diagonal matrix of positive square roots of the positive eigenvalues of the matrix $S^{-1}RS^{-1} - I$. Thus, the number of factors extracted equals Guttman's "strong" lower bound. This factor matrix can be modified, by modifying D, to yield an incomplete image analysis" (16, pp. 6-8).

FINDINGS

This section will be divided into three parts: comparisons of the four factor models, findings of the Alpha solution, and findings of Model D, as specified in the previous section.

Comparisons of Four Factor Models

Four factor models were applied to the data: incomplete principal components analysis, Alpha factor analysis, Joreskog's procedure, and Model D. Each initial solution was rotated by normal varimax procedures to obtain a derived orthogonal solution. In addition, two derived oblique solutions, independent cluster and Winsorizing, were applied to the Alpha and the Model D solutions.

Comparison of measures of fit. A measure of fit of the initial solution to the original correlations was determined by the average squared residual correlation. The average squared residual correlation was obtained by squaring the differences between R anf FF' (excluding the diagonals), and dividing the sum of squares by the number of elements in the off-diagonals of either matrix. Table I gives the measures of fit for the four models. The four models provided essentially the same measures of fit (16).

Comparison of mean h^2. The mean h^2 referred to the proportion of the total variance extracted by any one model. The incomplete principal components model took out the greatest proportion of the total variance, followed in order by Model D, Alpha, and Joreskog. This result was generally consistent with those of the Harris-Liba study (16).

TABLE I

CHARACTERISTICS OF FOUR FACTOR MODELS

Model	Number of Factors	Effective Number of Factors		Mean h^2	Average Squared Residual Correlation
		Factors	Common Factors		
Incomplete Principal Components	7	7	7	.603	.00093
Joreskog	5	5	5	.394	.00082
Alpha	7	7	7	.453	.00088
Model D	13	10	8	.475	.00091

Comparison of number of factors. The number of factors extracted by each model is given in Table I. The number of factors ranged from thirteen for Model D to five for Joreskog, with Alpha and incomplege principal components each yielding seven. However, in Model D, derived orthogonal solution, three of the thirteen factors were not effective, meaning that three factors did not have at least one variable with a coefficient of .30 or greater. Only eight of the thirteen factors had two or more variables with coefficients of .30 or more. The latter factors were classified as the effective number of common factors, while the factors with at least one variable with a loading of .30 or above were classified as the effective number of factors. Incomplete principal components, Alpha, and Joreskog had the same effective number of factors and the same effective number of common factors as the number of initial factors. Even though the number of initial factors for Model D was greater than the effective number of factors, the effective number of factors exceeded in number the factors for the other three models. This was consistent with the Harris-Liba results (16).

The range of effective number of factors over the four models was from ten factors for Model D to five for Joreskog. The range of effective number of common factors was from eight factors for Model D to five for Joreskog.

Discussion of model characteristics. The Joreskog model yielded the solution with the lowest mean communality and the smallest number of factors (five). The incomplete principal components model extracted the greatest proportion of the total variance. This model yielded a larger number of factors (seven) than Joreskog. This was to be expected since "the principal component model is designed for the determination of the components which present the largest variability, whereas the factor analysis models are intended primarily to find factors which contribute maximally to the correlations" (18, p. 11). The

Alpha model yielded a mean communality slightly higher than Joreskog, and the same number of factors (seven) as incomplete principal components. The mean communality of Model D was similar to that of Alpha. Model D extracted the largest number of factors (thirteen).

There were several considerations taken into account in the selection of models for presentation in this paper. In a recent study of the four models used in this study, the presentation of the results of two models was recommended (16).

First, Joreskog extracted fewer factors than Alpha. The number of factors extracted by Alpha is a minimum number; thus, a smaller number of factors would certainly be too few. For this reason, the Joreskog solution was not selected for presentation. However, the factor matrix for this solution is included in Appendix C.

As was expected, the incomplete principal components model yielded the highest proportion of variability and the same number of factors as Alpha. However, the component model is not a scale-free analysis. In other words, the scale of the original variables was changed in the form of a correlation matrix, to which the component model was applied. Should the data be rescaled in a different way, such as a variance-covariance matrix, the component analysis would yield a solution which differed from the solution obtained from the original rescaling, the correlation matrix. Alpha, on the other hand, was a scale-free analysis. No matter how the data were rescaled, the solutions yielded by Alpha would be proportionally related to one another. For this reason, the Alpha solution was selected for presentation rather than the incomplete principal components solution.

Model D was also selected for presentation, for two reasons. One, Model D was scale-free. Two, this model extracted the greatest number of factors. This latter feature was important since Alpha, as described earlier, probably extracted a minimum number of factors. It was logical that Model D would extract more factors than Alpha, since Model D used Guttman's strong lower bound while Alpha employed Guttman's weak lower bound. Since Model D was the only model to extract a greater number of factors than Alpha, this model might yield a more adequate description of the data.

Thus, the Alpha model and Model D were selected for presentation. Three derived solutions, one orthogonal and two oblique, were obtained for the Alpha initial solution. Two derived oblique solutions were obtained for the Model D initial solution. The derived orthogonal solution could not be presented because the set of nine factors for Model D was selected, as discussed in the next paragraph. The derived orthogonal solution was available only for the set of thirteen factors. The methods for obtaining the derived solutions were: orthogonal, Kaiser's normal varimax procedure (20); oblique, Harris-Kaiser independent cluster solution (15); oblique, Kaiser Winsorizing solution.

An interesting feature of the derived oblique models was that the number of factors could be set below the number obtained in an initial factor matrix, and a derived oblique solution could be obtained for that smaller number of factors. For example, the number of Model D factors could be set at ten, and the oblique rotations would yield derived oblique solutions for ten factors. In this study, the number of Model D factors was set at seven, to equal the number of factors extracted by Alpha. Then the number of factors was set at eight, and this process was continued until the number of factors in the initial factor matrix (thirteen) was reached. In this way, it was possible to observe the robustness of factors, and the points at which other variables broke away from factors on which they originally appeared. Through observation of the seven sets of factors (ranging from seven to thirteen factors in a set), the set of nine Model D factors was selected as the most logical representation of the data at hand. In addition, the nine factors were effective common factors, having two or more variables with loadings of .30 or above on each factor.

Although two derived oblique solutions were obtained for Alpha and Model D, only one for each initial solution was selected for presentation. The choice between the two oblique solutions was determined through a comparison of the pattern matrices of the two solutions. The pattern matrix with the greatest number of elements between -.100 and +.100 was selected for presentation. For the Alpha solution, the independent cluster pattern matrix contained 95 such elements, while the Winsorizing pattern matrix contained 86. For the Model D solution, the former contained 123 elements, while the latter contained 136. By this criterion, the derived oblique independent cluster solution was chosen for Alpha, and the Winsorizing solution for Model D with nine factors.

In summary, three derived solutions will be presented in the next section. For Alpha, the derived orthogonal solution and the derived independent cluster solution will be presented. For Model D with nine factors, the Winsorizing solution will be presented.

Alpha Initial Solution

Two derived solutions were selected for presentation, based on the criteria discussed in the previous section. These solutions were the derived orthogonal and the derived oblique independent cluster. Since the two solutions yielded similar results, only one, the derived oblique independent cluster, will be presented in detail. The basic similarities and differences between the two solutions will then be noted.

Derived Oblique Independent Cluster Solution

The Alpha initial solution extracted seven factors. Any variables with coefficients below .300 were discarded. In Table II are given the factors and the respective variables and their factor coefficients.

Factor I, Skills Involving Trunk Rotation - Extremity Action. Nine variables appeared on Factor I. These variables were:

TABLE II

ALPHA INITIAL SOLUTION

Derived Orthogonal and Derived Oblique Independent Cluster Solutions

Independent Cluster

Factor I:	# 9	Badminton Serve	.813
	# 6	Bowling	.721
	# 8	Volleyball Underarm Serve	.617
	# 4	Tennis Serve	.598
	#24	Soccer Punt	.560
	#11	Volleyball Sidearm Serve	.466
	#18	Hockey Drive	.441
	#10	Tennis Drive	.418
	# 5	Badminton Clear	.346
Factor II:	#14	Basketball Two-Hand Chest Pass	.838
	#12	Basketball One-Hand Push Pass	.492
Factor III:	#19	Basketball Underarm Pass	.539
	#21	Bounce-dribble	.509
	# 3	Volleyball Overarm Serve	.421
Factor IV:	#23	Soccer Place-kick	.803
	# 3	Volleyball Overarm Serve	.448
	#24	Soccer Punt	.311
Factor V:	#15	Basketball Overhead Pass	.731
	#17	Volleyball Overhead Pass	.681
	# 5	Badminton Clear	.565
	# 4	Tennis Serve	.418
	#25	Soccer Pass	.401
	# 2	Basketball Overarm Throw	.392
Factor VI:	#20	Wall Volley	.791
	#22	Basketball Throw and Catch	.710
Factor VII:	#16	Volleyball Chest Pass	.507
	#13	Basketball One-Hand Push Shot	.504

TABLE II (Cont'd.)

Orthogonal

Factor I:	# 9	Badminton Serve	.652
	# 6	Bowling	.619
	# 8	Volleyball Underarm Serve	.568
	#24	Soccer Punt	.563
	# 4	Tennis Serve	.556
	#10	Tennis Drive	.484
	#11	Volleyball Sidearm Serve	.450
	# 1	Softball Overarm	.444
	# 5	Badminton Clear	.432
	#18	Hockey Drive	.407
	# 7	Softball Underarm Throw	.360
Factor II:	#14	Basketball Two-Hand Chest Pass	.782
	#12	Basketball One-Hand Push Pass	.554
Factor III:	#19	Basketball Underarm Pass	.464
	#21	Bounce-dribble	.441
	# 3	Volleyball Overarm Serve	.381
Factor IV:	#23	Soccer Place-kick	.688
	# 3	Volleyball Overarm Serve	.465
	#24	Soccer Punt	.336
	# 1	Softball Overarm Throw	.308
Factor V:	#15	Basketball Overhead Pass	.568
	#17	Volleyball Overhead Pass	.543
	# 5	Badminton Clear	.492
	# 2	Basketball Overarm Throw	.416
	# 4	Tennis Serve	.404
	#25	Soccer Pass	.367
	# 1	Softball Overarm Throw	.342
Factor VI:	#20	Wall Volley	.664
	#22	Basketball Throw and Catch	.611
	# 2	Basketball Overarm Throw	.340
	# 1	Softball Overarm Throw	.311
Factor VII:	#16	Volleyball Chest Pass	.543
	#13	Basketball One-Hand Push Shot	.517

#9 Badminton Serve, #6 Bowling, #8 Volleyball Underarm Serve, #4 Tennis Serve, #5 Badminton Clear, #10 Tennis Drive, #11 Volleyball Sidearm Serve, #18 Hockey Drive, and #24 Soccer Punt. The execution of all these skills involved hip and spinal rotation and arm or leg action. However, the movements of these body parts may not have been wholly sequential. For example, in a skilled overarm throw, the body parts were probably used sequentially. The hip rotation was followed by spinal rotation, which is superceded by medial rotation of the humerus and finally wrist action. #1 Softball Overarm, which is executed sequentially, did not appear on this factor. The nine variables listed above utilized hip rotation - spinal rotation - extremity action, but some of these movements occurred simultaneously rather than sequentially. For example, in #10 Tennis Drive, the initial movement seemed to occur in the hips. The hip rotation was followed by spinal rotation and arm action which seemed to occur at the same time. In other words, the arm and the upper trunk essentially moved as a unit in the force-producing phase of the skill. Other skills seemed similar to the above nine, but did not appear on this factor. These skills were: #2 Basketball Overarm Throw, #3 Volleyball Overarm Serve, #23 Soccer Place-kick, and #7 Softball Underarm. Possibly the softball underarm, like the softball overarm, was executed sequentially. However, the softball underarm did not appear on any factor in this solution. With the soccer place-kick and the volleyball overarm serve, the occurrence of trunk rotation might have been practically non-existent. In the place-kick, the ball was kicked from a stationary position on the floor. Thus, the range through which trunk rotation could occur would certainly be limited in comparison with the soccer punt. Possibly, the execution of the volleyball serve tended to be a punching action, and so the trunk rotation would be minimal. The omission of the basketball throw on this factor indicated that this throw might be more like a pushing action. In addition, only one release skill, #6 Bowling, appeared on this factor. The rest were striking skills.

Factor II, Pushing Skills With No Height Restriction. Two variables appeared on Factor II: #14 Basketball Two-Hand Chest Pass and #12 Basketball One-Hand Push Pass. Both skills were pushing skills using a basketball. In addition, there was no minimum wall height for either test. Any wall contact height was acceptable. The chest pass was executed with two hands from chest level, while the push pass was executed with one hand from approximately shoulder level. However, these differences were not enough to separate the two variables.

Factor III, Skills Involving Elbow-Shoulder Action, Limited Wrist. Three variables appeared on Factor III: #19 Basketball Underarm Pass, #21 Bounce-dribble, and #3 Volleyball Overarm Serve. The similarities among these skills were not obvious ones. The volleyball serve, if properly executed, involved the sequential action discussed under Factor I. The spinal rotation would be added to the hip rotation, and then medial rotation of the humerus would follow the spinal rotation. Such an execution could be considered a skilled execution of the overarm volleyball serve. On the other hand, many of the subjects in this study were not skilled performers. Very few had previously been exposed to an overarm serve. Thus, many may have resorted to the use of a punching action to execute the serve. Were this the case, then certain similarities could be drawn among the skills appearing on this factor. The execution of all three skills involved primarily shoulder and elbow action. Elbow extension was common to the three skills. In addition, all three involved shoulder flexion. Of course, the projected objects were in different locations in relation to the body for all three skills. The wrist seemed to be relatively stabilized in all three skills, except for radial deviation in the basketball pass. Essentially, these skills tended to fall into the 'push' category.

Factor IV, Striking With Body Part-Sagittal Plane. Three variables appeared on Factor IV: #23 Soccer Place-kick, #3 Volleyball Overarm Serve, and #24 Soccer Punt. These three skills involved striking the ball with a body part in the sagittal plane. The two kicking skills were executed in a similar manner, with the difference lying in the point of contact. For the place-kick, the ball was contacted on the floor. For the punt, the ball was contacted in the air, several feet off the floor. In the volleyball serve, the suspended ball was contacted overhead. Two other skills did not appear on this factor but fitted this category. These skills were #25 Soccer Pass and #8 Volleyball Underarm Serve. However, the soccer pass was executed with the instep of the foot, which restricted the leg swing considerably. In the volleyball serve, the ball was contacted around waist or hip level. Perhaps this mid-body contact served to differentiate this skill from the three skills which made up this factor. In the latter three skills, the contact points were toward the upper and lower extremes of the body.

Factor V, Overarm-Overhead Pattern. Six variables appeared on Factor V: #15 Basketball Overhead Pass, #17 Volleyball Overhead Pass, #5 Badminton Clear, #4 Tennis Serve, #25 Soccer Pass, and #2 Basketball Overarm Throw. All of these skills, with one exception, were executed with an overarm or overhead movement. The two skills with the highest loadings on this factor were #15 and #17. Both skills were bilateral, and the ball was released or contacted from an overhead position. The remaining skills, with the exception of the soccer pass, were executed with one hand in an overarm movement. (Overarm in this sense refers to a release or contact over the shoulder and somewhat in front of the body.) The logical relationship of the soccer pass to the other five skills was not apparent. Two additional skills which were executed with one hand in an overarm position did not load on this factor. These skills were #3 Volleyball Overarm Serve and #1 Softball Overarm Throw. Since the softball overarm throw involved releasing a small object from the hand, this skill was probably executed sequentially by all subjects. As medial rotation of the arm occurred, the release point was forced out to the side and in front of the body, rather than being at an overhead or over-the-shoulder location. One should note, also, that the softball overarm did not appear on any factor in this solution. In the volleyball overarm serve, the ball was contacted at a position somewhat in front of the body and above shoulder height. In terms of point of contact, this skill was not very different from some which appeared on this factor. However, the range through which the movement occurred was limited in comparison with the above six skills.

Factor VI, Repeated Measures Against Wall. Two variables appeared on Factor VI: #20 Wall Volley and #22 Basketball Throw and Catch. These variables were both repeated measures, and were executed against the wall. One skill involved striking a volleyball with two hands, while the second involved releasing a basketball with two hands. A third repeated measure, #21 Bounce-dribble, failed to appear on this factor. This skill was executed against the floor, and apparently involved some elements not related to those used in the execution of #20 and #22.

Factor VII, Pushing Skills With Height Restrictions. Two variables appeared on Factor VII: #16 Volleyball Chest Pass and #13 Basketball One-Hand Push Shot. These variables were similar in two respects. One, both skills were executed by pushing the projectile. Two, the ball had to be projected so that it contacted the wall on or above a specified height. For #16, the minimum height was nine feet; for #13, ten feet. The height restriction forced the subjects to execute a diagonally upward push. The skills were different in that one involved striking a volleyball whereas the other involved releasing a basketball. However, these differences were apparently not great enough to separate the two skills.

Derived Orthogonal Solution

The derived orthogonal solution yielded essentially the same results as the derived independent cluster solution. Rather than repeating the latter results, this section will be devoted to noting the minor differences between the two derived solutions.

Factor I, Skills Involving Trunk Rotation-Extremity Action. Eleven variables appeared on Factor I. This factor was similar to Factor I, oblique, but two variables were added. These variables were #1 Softball Overarm and #7 Softball Underarm. The inclusion of these variables made a stronger case for classifying these skills under the above factor heading, but weakened the case for classifying this group as striking skills.

Factor II, Pushing Skills With No Height Restrictions. Two variables appeared on Factor II. This factor was the same as Factor II, oblique.

Factor III, Skills Involving Elbow-Shoulder Action, Little Wrist. Three variables appeared on Factor III. This factor was the same as Factor III, oblique.

Factor IV, Striking With Body Part-Sagittal Plane. Four variables appeared on Factor IV. This factor was similar to Factor IV, oblique, but one variable was added. This variable was #1 Softball Overarm. The relationship of this variable to the others was not readily explainable.

Factor V, Overarm-Overhead Pattern. Seven variables appeared on Factor V. This factor was similar to Factor V, oblique, but one variable was added. This variable was #1 Softball Overarm.

Factor VI, Repeated Measures Against Wall. Four measures were included in Factor VI. This factor was similar to Factor VI, oblique, but two variables were added. These variables were #2 Basketball Overarm Throw and #1 Softball Overarm. The inclusion of these variables weakened the case for classifying this factor as repeated measures. However, the two throws had moderate coefficients on this factor while the repeated measures had high coefficients.

Factor VII, Pushing Skills With Height Restrictions. Two variables appeared on Factor VII. This factor was the same as Factor VII, oblique.

Summary of the Findings for the Alpha Solution. The Alpha solution yielded seven factors. The derived oblique independent cluster was presented in detail. One factor was represented by items which measure skills involving trunk rotation and extremity action. Most of these skills were striking skills. Two factors were identified by pushing skills, where one factor included a height restriction while the second had no such restriction. One factor was represented by skills which involved striking the ball with a body part, moving in the sagittal plane. One factor was represented by repeated measures against the wall. One factor was represented by skills involving elbow-shoulder action, with little wrist action. One factor was identified by skills which were executed from an overhead or overarm position. For the derived orthogonal solution, the factors were identified in basically the same way, except that for four of the factors the number of variables which appeared on the factor was slightly larger than in the oblique solution.

Model D Initial Solution

One derived solution was selected for presentation, based on the criteria described in an earlier section. This solution was the oblique Winsorizing solution.

Derived Oblique Winsorizing Solution

The Model D initial solution extracted thirteen factors. With the oblique solution, factor patterns were obtained for the range of seven through thirteen factors. The factor pattern for nine factors was selected for presentation in this section. This set of nine factors is given in Table III.

Factor I, Skills Involving Hip-Spinal-Extremity Sequential Action - Striking. Five variables appeared on Factor I: #4 Tennis Serve, #8 Volleyball Underarm Serve, #9 Badminton Serve, #5 Badminton Clear, and #24 Soccer Punt. All of these skills were striking skills. Two skills involved overarm movements, while the remaining three involved underarm movements. The four skills involving the arm might represent the striking skills that utilize sequential action in some limited form. At least these skills utilized more sequential action than the sidearm striking skills, which did not appear on this factor. On the other hand, the degree of sequential action might have been less than that of the softball throw, which also did not appear on this factor. The soccer punt appeared on this factor, but not the soccer place-kick and the soccer pass. Again, the range of movement of the latter two kicks was less than the former, thus requiring less rotation. Also missing from this factor were #3 Volleyball Overarm Serve and #18 Hockey Drive. The probability of a small amount of rotation being used in the serve was discussed in the last section. The hockey drive was a bilateral striking skill, in which the body facing was forward and the backswing was limited by the height of the shoulder. These features

TABLE III

MODEL D INITIAL SOLUTION

Derived Oblique Winsorizing Solution

Factor I:	# 4	Tennis Serve	.907
	# 8	Volleyball Underarm Serve	.595
	# 9	Badminton Serve	.570
	# 5	Badminton Clear	.563
	#24	Soccer Punt	.375
Factor II:	#14	Basketball Two-Hand Chest Pass	.699
	#12	Basketball One-Hand Push Pass	.677
Factor III:	#21	Bounce-dribble	.559
	#19	Basketball Underarm Pass	.383
	# 3	Volleyball Overarm Serve	.366
Factor IV:	#23	Soccer Place-kick	.582
	# 3	Volleyball Overarm Serve	.366
	#10	Tennis Drive	.352
Factor V:	#16	Volleyball Chest Pass	.449
	#13	Basketball One-Hand Push Shot	.408
Factor VI:	#17	Volleyball Overhead Pass	.591
	#15	Basketball Overhead Pass	.535
	# 9	Badminton Serve	-.413
	#25	Soccer Pass	.310
Factor VII:	#22	Basketball Throw and Catch	.883
	#20	Wall Volley	.777
	# 2	Basketball Overarm Throw	.564
	# 1	Softball Overarm Throw	.457
Factor VIII:	#18	Hockey Drive	.639
	#11	Volleyball Sidearm Serve	.582
	# 6	Bowling	.378
	# 1	Softball Overarm Throw	.348
Factor IX;	#10	Tennis Drive	.424
	# 2	Basketball Overarm Throw	-.375
	#24	Soccer Punt	.319
	#11	Volleyball Sidearm Serve	.313
	# 6	Bowling	.307

limited the amount of rotation that could occur.

Factor II, Pushing Skills With No Height Restriction. Two variables appeared on Factor II: #14 Basketball Two-Hand Chest Pass and #12 Basketball One-Hand Push Pass. This factor was the same as Factor II, Alpha initial solution, derived independent cluster solution.

Factor III, Skills Involving Elbow-Shoulder Action, Little Wrist. Three variables appeared on Factor III: #21 Bounce-dribble, #19 Basketball Underarm Pass, and #3 Volleyball Overarm Serve. This factor was the same as Factor III, Alpha initial solution, derived independent cluster solution.

Factor IV, Unnamed. Three variables appeared on Factor IV: #23 Soccer Place-kick, #3 Volleyball Overarm Serve, and #10 Tennis Drive. The unique relationships among these skills were not readily apparent.

Factor V, Pushing Skills With Height Restrictions. Two variables appeared under Factor V: #16 Volleyball Chest Pass and #13 Basketball One-Hand Push Shot. This factor was the same as Factor VII, Alpha initial solution, derived independent cluster solution.

Factor VI, Overhead Pattern. Four variables appeared on Factor VI: #17 Volleyball Overhead Pass, #15 Basketball Overhead Pass, #9 Badminton Serve, and #25 Soccer Pass. The first two items, #17 and #15, were executed similarly. Both were bilateral overhead movements, although one was a striking skill and the other, a releasing skill.

The badminton serve had a negative coefficient on this factor, indicating that the first two skills involved elements which differed from a unilateral underarm skill involving striking with an implement. There appeared to be no reasonable explanation for the soccer pass loading on this factor.

Factor VII, Repeated Measures Against Wall. Four variables appeared on this factor: #22 Basketball Throw and Catch, #20 Wall Volley, #2 Basketball Overarm Throw, and #1 Softball Overarm. This factor is the same as Factor VII, Alpha initial solution, derived orthogonal solution.

Factor VIII, Unnamed. Four variables appeared on this factor: #18 Hockey Drive, #11 Volleyball Sidearm Serve, #6 Bowling, and #1 Softball Overarm. The unique relationships among these skills were not apparent.

Factor IX, Sidearm Skills. Five variables appeared on Factor IX: #10 Tennis Drive, #2 Basketball Overarm Throw, #24 Soccer Punt, #11 Volleyball Sidearm Serve, and #6 Bowling. The basketball throw loaded negatively on this factor. Two of these skills, the tennis drive and the volleyball serve, were striking skills involving sidearms. This is the only factor on which both sidearm skills appeared. Since the soccer punt and the bowling could be classified as underarm movements, perhaps the degree of joint actions among these underarm and sidearm movements was similar.

Summary of the Findings for the Model D Solution. Model D yielded thirteen factors. The derived oblique Winsorizing solution was presented for the Model D solution of nine factors, since the set of nine seemed to allow the most logical interpretation of the data. One factor was represented by skills involving hip-spinal-extremity sequential action. These skills were striking skills. Two factors were identified by pushing skills, where one factor included a height restriction while the second had no such restriction. One factor was represented by repeated measures against the wall. One factor was represented by skills involving elbow-shoulder action, with little wrist action. One factor was identified primarily by skills executed from an overhead position. One factor was represented by the two sidearm striking skills which were included in this study. Two factors were not named.

DISCUSSION

In the objectives section of this paper, three sets of factors were hypothesized representing different logical combinations of the variables which were to be included in this study. One set, Pattern A, hypothesized three factors: skills involving one arm, skills involving both arms, and skills involving the legs. A second set, Pattern B, hypothesized five factors: overarm skills, sidearm skills, underarm skills, pushing skills, and kicking skills. A third set, Pattern C, hypothesized three factors: releasing skills, striking skills, and skills involving repeated executions. Examination of the results of the data analyses indicated that the original hypothesized sets were an inadequate representation of the skills in question. The actual factor patterns were almost totally dissimilar to the hypothesized factor patterns.

Pattern A, consisting of three factors, was much too simple to accurately represent the data. There was no evidence that skills group themselves according to the extremity used.

In Pattern C, the breakdown of skills into a striking factor and a release factor was again too gross a representation of the data. However, a repeated measures factor, also hypothesized under Pattern C, was extracted in both Alpha and Model D solutions. The results of these solutions indicated that certain directional differences might exist among repeated measures items. The items executed in a diagonally upward direction and in a forward direction appeared together, while an item executed in a downward direction appeared separately. This separation was not hypothesized in Pattern C.

In Pattern B, the hypothesized push factor was substantiated in the results of both solutions. However, two types of pushes, depending on the direction of execution, were found in this study, but were not originally hypothesized. One type was executed in a diagonally upward direction, while the second was directed straight forward. The remaining hypothesized factors were not extracted in the results of either solution. The Overarm Pattern, Sidearm Pattern, Underarm Pattern, and Kick Pattern were not, in the final analysis, meaningful groupings for the variables in question. Instead, these skills seemed to be differentiated by the degree of sequential action which occurred during execution. One might note that Factor V, Overarm-Overhead Skills, Alpha initial solution seemed similar to the Overarm Pattern under Pattern B. Actually, the term overarm referred to the hip-spine-shoulder-wrist sequential action. Thus, the Pattern B Overarm Pattern was undoubtedly misnamed. This was borne out in the Model D solution, where the bilateral overhead passes appeared separately from the other so-called overarm skills. The remaining 'overarm' skills were scattered over several factors in the Model D solution, probably because these skills involved different combinations of hip-spinal-arm action. The skills under the remaining patterns in Pattern B also seemed to be differentiated among by the amount and kind of joint action necessary for execution.

The Alpha solution and the Model D solution yielded similar results, although the Model D solution seemed more accurate due to a greater number of factors. Five of the factors in the Alpha solution were almost identical to factors in the Model D solution. Two others, Factors I and V, were broken down in the Model D solution and thus made more explicit. The striking skills involving some sequential action remained together, and the bilateral overhead passes were pulled away from the other so-called overarm skills. The pieces broken off from Factors I and V formed Factors VIII and IX in the Model D solution, but were difficult to explain adequately.

Some variables did not appear on any factor, or appeared on several with low or moderate coefficients. These variables, then, were not accurately placed by the analyses used in this study, and were usually difficult to interpret when they appeared. These variables were #1 Softball Overarm, #2 Basketball Overarm, #3 Volleyball Overarm, and #7 Softball Underarm Throw.

In a recent study of strength variables (23), five test items were included which measured the ability to project objects. These five items were overarm throw, volleyball overarm serve, basketball overarm throw, tennis serve, and medicine ball put. Two analyses were used: Alpha and Joreskog. In the Alpha analysis, all five test items loaded on one factor. In the Joreskog analysis, four of the items were split into two factors. One factor included overarm throw, volleyball serve, and basketball throw, while the second included only the tennis serve. The medicine ball put had a coefficient below .30 on both of the Joreskog factors. In this study, there was no factor on which the two throws and the volleyball serve loaded together, as was true in the Liba-Harris study. However, one throw, the basketball, in the Liba-Harris study was measured by distance, whereas this study used a velocity measure. In addition, the subjects in the Liba-Harris study were college women, while the subjects in this study were high school juniors and seniors. At any rate, the Liba-Harris Joreskog solution yielded a differentiation among skills which seem similar in many ways, thus indicating a need for further research in the so-called overarm pattern. This study revealed added complexities among overarm-sidearm-underarm skills which need extensive investigation. The results also indicated that there was no basis for differentiating between skills executed by the upper extremities and skills executed by the lower extremities.

In conclusion, the findings of this study indicated that the underlying relationships among gross motor skills were more complex than the logical relationships hypothesized in the literature and in this study. In addition, the structure of gross motor skills when performed by subjects of an average skill level might be different from the structure for highly skilled individuals.

BIBLIOGRAPHY

1. Benson, C.R., "A Factor Analysis of Tests of Balance, Kinesthesis, and Motor Patterns for Projecting an Object -- With and Without Vision", Unpublished Dissertation, University of Wisconsin, Madison, 1964.

2. Broer, M.R., Efficiency of Human Movement, Philadelphia: W.B. Saunders Company, 1963.

3. Brogden, H., et. al., "A Factor Analysis of Measures of Physical Proficiency", An unpublished report from the Personnel Research Section, Department of Army, PSR Report 937, Project 29534100m 1952.

4. Cognill, G.E., Anatomy and the Problem of Behavior, Cambridge: University Press, 1929.

5. Cooper, J.M. and Glassow, R.B., Kinesiology, St Louis: The C.V. Mosby Company, 1963.

6. Dennis, W., "Spalding Experiment on the Flight of Birds Repeated with Another Species", Journ. of Comparative Psychol. 31: 337-48, 1941.

7. Dusenberry, L., "A Study of the Effects of Training in Ball Throwing by Children Ages Three to Seven", Research Quarterly 23: 9-14, 1952.

8. Fleishman, E. A., "A Factor Analysis of Physical Fitness Tests", Educ. and Psychol. Meas. 23: 647-61, 1963.

9. Gesell, A. and Ames, L.B., "The Ontogenetic Organization of Prone Behavior in Human Infancy", Journal of Genetic Psychol. 56: 247-63, 1940.

10. Glassow, R.B., "A Study of Procedures in the Teaching of Motor Skills", An unpublished paper presented at the University of Wisconsin, Madison, 1952.

11. Guttman, L., "Image Theory for the Structure of Quantitative Variates", Psychometrika 19: 149-62, 1954.

12. Harman, H.H., Modern Factor Analysis, Chicago: The University of Chicago Press, 1960.

13. Harris, C.W., "Some Rao-Guttman Relationships", Psychometrika 27: 247-63, 1962.

14. Harris, C.W., "Some Recent Developments in Factor Analysis", Educ. and Psychol. Meas. 24: 193-206, 1964.

15. Harris, C.W. and Kaiser, H.F., "Oblique Factor Analytic Solutions by Orthogonal Transformations", Psychometrika 29: 347-62, 1964.

16. Harris, C.W. and Liba, M.R., "Operating Characteristics of Four Factor Models", Educ. and Psychol. Meas., in press.

17. Hovland, C.I., "Human Learning and Retention", In Handbook of Experimental Psychology edited by S.S. Stevens, New York: John Wiley and Sons, 1951. pp. 613-89.

18. Joreskog, K.G., Statistical Estimation in Factor Analysis, Stockholm: Almqvist and Wiksell, 1963.

19. Kaiser, H.F., "Image Analysis", In Problems in Measuring Change edited by C.W. Harris, Madison: University of Wisconsin Press, 1963, pp. 156-66.

20. Kaiser, H.F., "The Varimax Criterion for Analytic Rotation in Factor Analysis", Psychometrika 23: 187-200, 1958.

21. Kaiser, H.F. and Caffrey, J., "Alpha Factor Analysis", Psychometrika 30: 1-14, 1965.

22. Liba, M.R., "The Components of Motor Performance Tests Used for Exemption", Unpublished Paper, University of Wisconsin, 1964.

23. Liba, M.R. and Harris, C.W., "Factor Analysis of Strength Variables", Research Quarterly, in press.

24. Introduction to Movement, Part I, Department of Physical Education for Women, University of Wisconsin, Madison: College Printing and Typing Company, Inc., 1963.

25. McGraw, M.B., Growth: A Study of Johnny and Jimmy, New York: Appleton-Century, 1935.

26. Mortimer, E. M., "Basketball Shooting", Research Quarterly 22: 234-43, 1951.

27. Munn, N. L., "Learning in Children", In Manual of Child Psychology edited by L. Carmichael, New York: Wiley, 1954.

28. Ponthieux, N. A. and Barker, D. G., "An Analysis of the AAHPER Youth Fitness Test", Research Quarterly 34: 525-26, 1963.

29. Ransom, S. W., The Anatomy of the Nervous System, Philadelphia: W. B. Saunders Company, 1943.

30. Rao, C. R., "Estimation and Tests of Significance in Factor Analysis", Psychometrika, 20: 149-62, 1955.

31. Shirley, M. M., The First Two Years: A Study of Twenty-Five Babies, Vol. I, Postural and Locomotor Development, Minneapolis: University of Minnesota Press, 1931.

32. Spearman, C., "General Intelligence Objectively Determined and Measured", American Journ. of Psychol. 15: 201-293, 1904.

33. Souder, M. A. and Hill, P. J., Basic Movement Foundations of Physical Education, New York: The Ronald Press Company, 1963.

34. Thurstone, L. L., "Multiple Factor Analysis", Psychol. Rev. 38: 406-27, 1931.

35. Wild, M. R., "The Behavior Pattern of Throwing and Some Observations Concerning Its Course of Development in Children", Unpublished Doctoral Dissertation, University of Wisconsin, Madison, 1937.

36. Zingg, R. M., "Feral Man and Extreme Cases of Isolation", Amer. Journ. of Psychol. 53: 487-517, 1940.

APPENDIX A

Test Descriptions

and

Directions for Administration

APPENDIX A

There were certain testing devices which remained constant throughout the testing program. The wall target was used in twenty tests. The suspension device was used in five tests. In addition, velocity scores were computed for many tests. Therefore, these features will be described prior to presenting the detailed test descriptions and directions for administration.

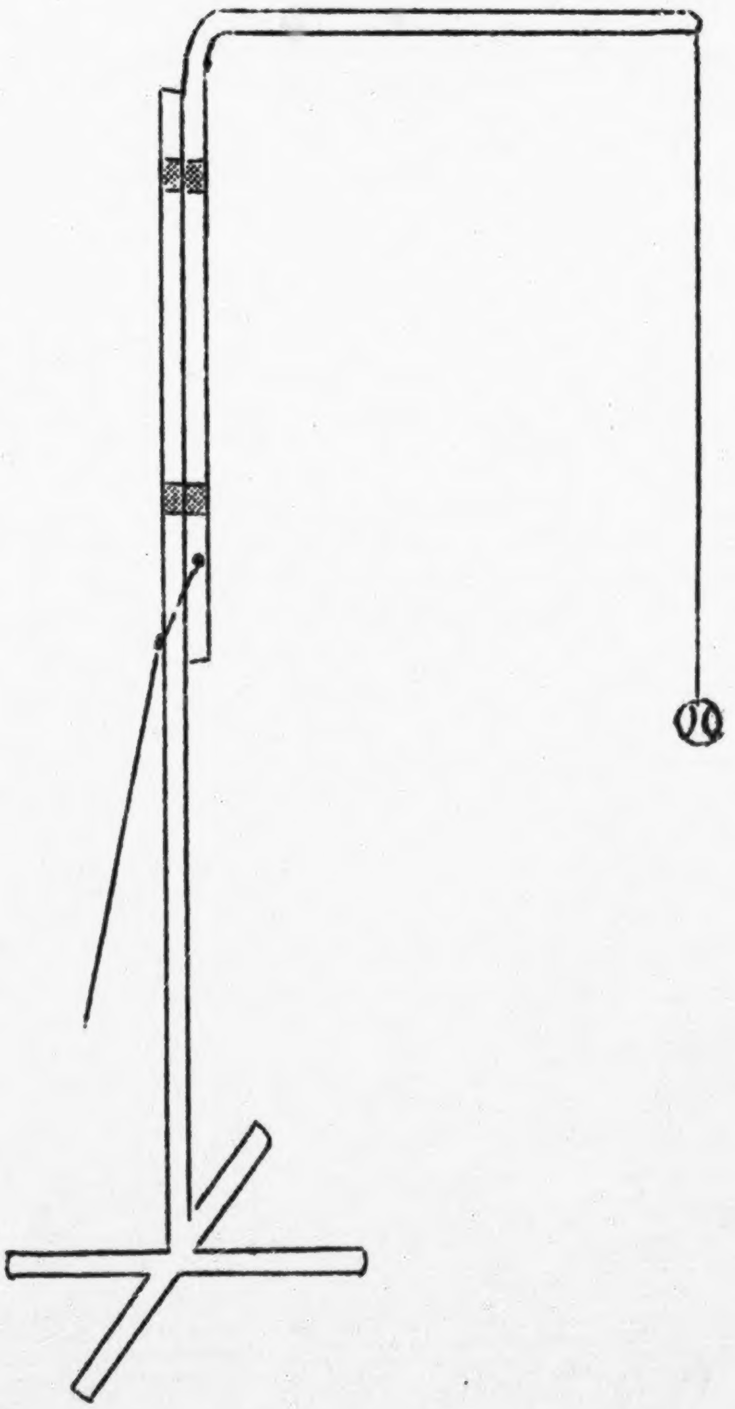
Wall target. Since velocity scores are used for twenty tests, and since the distance was set, it was necessary to record the height of wall contact for each projectile. To facilitate recording these heights, a simple target was placed on the wall. The target consisted of masking tape lines placed one foot apart on the wall. Large 5 x 8 index cards numbered to represent feet from the floor were taped between the lines.

The maximum height of the target was twenty-five feet. This height was selected because the wall space above that point was obstructed. The width of the target was eleven feet, nine inches. The choice of this width was based on the following criterion. If an object were projected against the wall several times at the same speed and from the same distance, the projectile could contact the wall at any point on a horizontal line within this range (11'9") without altering the velocity more than two feet per second.

Suspension device. A suspension device was constructed so that certain striking skills could be executed using a suspended ball. A drawing of this device is shown in Figure X. The pole, a hollow aluminum tubing called conduit, was attached to a volleyball standard. A 25-pound fishing line was threaded through the pole. The lower part of the line was

Figure X

Suspension Device



secured to the standard. The upper part of the line was attached to a piece of magnetic lace, known as Velcron. Magnetic lace refers to two pieces of material which adhere to one another. The other piece of magnetic lace was glued to a projectile. The two pieces of magnetic lace were pressed together, and the ball was thus suspended. The height of the projectile could be adjusted by winding or unwinding the string at its attachment to the volleyball standard.

Computation of velocity scores. Many of the tests in this section yielded velocity scores. These velocity scores are described specifically in the Procedures section. These scores can be computed by procedures described by Mortimer (26). However, this procedure has been programmed for the computer, and tables of velocity scores are now available.

This is a sample of the information which can be obtained from the velocity tables:

Horizontal Distance = 30'
* Difference in Height = 3'

Time (Sec.)	Theta (Deg.)	VO (Ft. /Sec.)
.58	7.91	52.22
.59	8.37	51.39
.60	8.83	50.60
.61	9.28	49.83

* Wall height minus release or contact height

#1 OVERARM SOFTBALL THROW

Objective. The objective of this test is to measure the ability to forcefully project a softball using an overarm throw.

Equipment. Softballs
Fast stopwatches (capable of recording time to .01 of a second)

Restraining line. 30'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we want to know how fast you can throw a softball against the wall. You should use an overarm throw. If you would like to take a step forward as you throw, you may. However, you must not step on or over the restraining line. Remember - you should throw the ball as fast as you can.

Instructions to timer. Start the watch when the ball leaves the hand. Stop the watch when the ball contacts the wall. Be sure the throw is overarm, not sidearm. If the student uses a sidearm throw, do not count that trial.

Instructions to recorder. Be sure the subject does not step on or over the restraining line. Note the wall height and record to the nearest foot. Record time to the nearest hundredth of a second. Record release height. *When a trial cannot be scored (for example, when the ball does not hit the wall), put a check on the score sheet by the appropriate trial number.

Number of trials. 4

Reliability. .857

*This instruction was given to the recorders at the beginning of the testing program, and was appropriate for all tests.

#2 OVERARM BASKETBALL THROW

Objective. The objective of this test is to measure the ability to forcefully project a basketball against the wall using an overarm pattern.

Equipment. Basketballs
Fast stop watch

Restraining line. 30'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we are interested in how fast you can throw a basketball from behind this line (point to restraining line) to the wall. Start with the ball resting in the hand, palm up. The ball should be in back of the head. Be sure that you throw, not push, the ball. (Demonstrate) You may take one step, if you wish, as long as you do not step over the line. Remember to throw the ball as fast as you can.

Instructions to timer. As soon as the ball leaves the hand, start the watch. Stop the watch when the ball contacts the wall. It is your responsibility to note whether the student throws or pushes the ball. A throw is indicated by bringing the ball in back of the head, and releasing the supporting hand there. A push is executed by keeping the ball in front of the body. No push passes are to be recorded. If the student executes a push rather than a throw, repeat the trial.

Instructions to recorder. Note the height at which the ball contacts the wall. Record wall height to the nearest foot. Record the time to the nearest hundredth of a second. Record release height. Also, be sure the student does not step on or over the restraining line.

Number of trials. 4

Reliability. .686

#3 VOLLEYBALL OVERARM SERVE

Objective. The objective of this test is to measure the ability to forcefully project a volleyball with the hand, using an overarm swing.

Equipment. Volleyballs (magnetic lace attached)
Fast stopwatches
Suspension equipment

Restraining line. 15'

Personnel. Timer
Recorder
Ball suspender

Instructions to subjects. In this test, we are interested in how fast you can hit a volleyball against the wall, using an overarm swing. As you can see, the ball is suspended, so you will not have to toss it to yourself. If the height of the ball is not comfortable for you, it can be adjusted. You may step into your hit, if you wish, as long as you do not step on or over the restraining line. Try hitting the ball easily to get used to hitting a suspended ball. Now make the next few hits harder. Remember, you should hit the ball as hard as you can.

Instructions to timer. Start the watch when the hand contacts the ball. Stop the watch when the ball hits the wall.

Instructions to recorder. Be sure the subject does not step on or over the restraining line. Note the wall height, and record to the nearest foot. Record time score to the nearest hundredth of a second. Record contact height.

Instructions to ball suspender. Adjust the ball height for each subject, according to her reach with her striking arm held overhead. After each hit, suspend another ball and stabilize it for the next trial.

Number of trials. 8

Reliability. .845

#4 TENNIS SERVE

Objective. The objective of this test is to measure the ability to forcefully project a tennis ball with a tennis racket, using an overarm movement.

Equipment. Tennis balls
Tennis rackets
Suspension equipment
Fast stop watches

Restraining line. 30'

Personnel. Timer
Recorder
Ball suspender

Instructions to subjects. In this test, we want to know how fast you can hit a tennis ball against the wall. This skill is somewhat like a tennis serve; however, it does not matter whether you have played tennis before. The ball is suspended, as you can see, so you will not have to toss it to yourself. Try hitting the ball easily one or two times to get used to hitting a suspended ball. If the height of the ball is not comfortable for you, it can be altered. Now try hitting the ball harder.

Instructions to timer. Start the watch when the ball is contacted by the racket. Stop the watch when the ball hits the wall. Note the time to the nearest hundredth of a second.

Instructions to recorder. Adjust the ball height for each subject. See that the subject does not step on or over restraining line while hitting the ball. Note the wall height, and record to the nearest foot. Record time to the nearest hundredth of a second. Note the contact height. Check all misses.

Instructions to ball suspender. As soon as the subject hits a ball, suspend another and stabilize if for the next trial.

Number of trials. 8

Reliability. .813

#5 BADMINTON OVERHEAD CLEAR

Objective. The objective of this test is to measure the ability to forcefully project a cork ball* against the wall with a squash racket* using an overarm swing.

Equipment. Cork balls
Squash rackets
Suspension equipment
Fast stop watches

Restraining line. 40'

Personnel. Timer
Recorder
Ball suspender

Instructions to subjects. In this test, we want to know how fast you can hit a cork ball against the wall with a squash racket using an overarm swing. It does not matter whether or not you have ever played badminton. Simply do the best you can. As you can see, the ball is suspended, so it will be easier for you to hit it. (Adjust ball to height of subject) Take a few practice trials to see if the height of the ball is comfortable for you. You may take a step if you wish, as long as you remain in back of the restraining line. Remember that we are interested in how fast you can hit the ball.

Instructions to timer. Start the watch when the racket contacts the ball. Stop the watch when the ball reaches the wall. Note the wall height to the nearest foot.

Instructions to recorder. Record time and wall height. Watch the foul line. Note the contact height. Check all misses.

Instructions to ball suspender. After each hit, suspend another ball and retrieve the one that has been hit.

Number of trials. 8

Reliability. .816

* The cork ball was chosen because it is similar in size to a badminton shuttlecock, the flight of which is altered too much by air resistance to obtain an accurate velocity measure. The squash racket was selected because of its similarity to a badminton racket, which was too light to handle a cork ball.

#6 BOWLING

Objective. The objective of this test is to measure the ability to forcefully project a bowling ball using an underarm movement.

Equipment. Bowling balls (Light weight balls -- weight constant)
Fast stop watches

Restraining line. 63'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we would like for you to roll the bowling ball down the alley as fast as you can. All the pins will be removed, as we are not concerned with accuracy, but with speed. Remember to roll the ball as fast as you can.

Instructions to timer. As soon as the ball passes over the foul line, start the watch. As soon as the lights at the end of the alley strike the ball, stop the watch. Do not time a ball that goes into the gutter.

Instructions to recorder. Record the time to the nearest hundredth of a second. Watch the foul line. Check all misses.

Number of trials. 4

Reliability. .909

# 7 SOFTBALL THROW (UNDERARM)

Objective. The objective of this test is to measure the ability to forcefully project a softball using an underarm throw.

Equipment. Softballs
Fast stop watch

Restraining line. 30'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we want to know how fast you can throw a softball against the wall. You should use an underarm throw. If you would like to take a step forward as you throw, you may. You must not step over the restraining line as you throw. Remember -- you should throw as fast as you can.

Instructions to timer. Start the watch when the ball leaves the hand. Stop the watch when the ball contacts the wall. Be sure the throw is underarm, not sidearm. If a student uses a sidearm throw, do not count that trial.

Instructions to recorder. Be sure the subject does not step over (or on) the restraining line. Note the wall height, and record to the nearest foot. Record time to the nearest hundredth of a second. Note the release height. Check all misses.

Number of trials. 4

Reliability. .701

#8 VOLLEYBALL SERVE (UNDERARM)

Objective. The objective of this test is to measure the ability to forcefully project a volleyball using an underarm movement.

Equipment. Volleyballs
Fast stop watches

Restraining line. 30'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we want to know how fast you can hit a volleyball against the wall using an underarm movement. (Next instructions are for a right-handed individual.) This is just like an underarm serve in volleyball. Hold the ball in your left hand, and hit the ball as hard as you can with your right hand. You may take a step if you wish, as long as you remain in back of the restraining line. Remember that we are interested in how fast you can hit the ball.

Instructions to timer. Start the watch when the ball is contacted by the striking hand. Stop the watch when the ball reaches the wall. Note the wall height of ball contact to the nearest foot.

Instructions to recorder. Encourage hitting the ball out-of-hand rather than tossing the ball and hitting it. Be sure the arm swing is underarm, not sidearm. Check to see that the subject does not step over the line. Record time and wall height. Note the striking height.

Number of trials. 6

Reliability. .834

#9 BADMINTON UNDERARM SERVE

Objective. The objective of this test is to measure the ability to forcefully project a cork ball against the wall with a squash racket using an underarm movement.

Equipment. Cork balls
Squash rackets
Fast stop watches

Restraining line. 30'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we want to know how fast you can hit a cork ball against the wall with a squash racket using an underarm movement. Hold the ball in your left hand (for right-handed individuals), and drop the ball as you swing the racket forward. (Demonstrate). Remember that you should try to hit the ball as hard, or as fast, as you can. You may take a step if you wish, as long as you remain in back of the restraining line. It does not matter whether or not you have ever played badminton. Simply do the best you can.

Instructions to timer. Start the watch when the racket contacts the ball. Stop the watch when the ball reaches the wall. Note the wall height to the nearest foot.

Instructions to recorder. Record the time and the wall height. Watch the restraining line. Note the contact height.

Number of trials. 6

Reliability. .761

# 10 TENNIS DRIVE

Objective. The objective of this test is to measure the ability to forcefully project a tennis ball using a sidearm movement (with a tennis racket).

Equipment.
Tennis balls
Tennis rackets
Suspension equipment
Fast stop watches

Restraining line. 30'

Personnel.
Timer
Recorder
Ball suspender

Instructions to subjects. In this test, we want to see how fast you can hit a tennis ball against a wall, using a sidearm movement. As you can see, the ball is suspended, and you will hit it from that position. (The ball should be suspended at the top of the subject's hip.) If the ball height is not comfortable for you, it can be adjusted. Try a few hits swinging easily, to get the idea of hitting a suspended ball in this way. You can step into the swing if you wish, as long as you do not step on or over the restraining line. Remember that you should hit the ball as fast as you can. Take a few more practice trials, hitting harder.

Instructions to timer. Start the watch when the racket contacts the ball. Stop the watch when the ball hits the wall. Note the time to the nearest hundredth of a second.

Instructions to recorder. Be sure that the subject does not step on or over the restraining line. Note the wall height, and record to the nearest foot. Record the time. Note the contact height.

Instructions to ball suspender. Adjust the height of the ball for each subject. After each hit, suspend another ball and stabilize it for the next trial.

Number of trials. 8

Reliability. .871

#11 VOLLEYBALL SERVE (SIDEARM)

Objective. The objective of this test is to measure the ability to forcefully project a volleyball using a sidearm movement.

Equipment.
- Volleyballs
- Fast stop watches
- Suspension equipment

Restraining line. 15'

Personnel.
- Timer
- Recorder
- Ball suspender

Instructions to subjects. In this test, we would like to know how fast you can hit a volleyball against the wall using a sidearm movement. You can see that the volleyball is suspended. Take a few practice trials, hitting easily, to get accustomed to hitting a suspended ball. Now try one or two hitting a little harder. Now we will take the actual test trials. Remember we are interested in how fast you can hit the ball. You may take a step, if you wish, as long as you do not step on or over the restraining line. (Demonstrate, if necessary.)

Instructions to timer. Start the watch when the striking hand contacts the ball. Stop the watch when the ball hits the wall. Note wall height and time.

Instructions to recorder. Check to see that the subject does not step on or over the restraining line. Record the wall height to the nearest foot, and time to the nearest hundredth of a second. Note the contact height.

Instructions to ball suspender. Adjust the suspended ball for each subject to slightly below shoulder level. The ball height should force the subject to use a sidearm pattern. As soon as the ball is hit, suspend another ball and stabilize it for the next trial.

Number of trials. 8

Reliability. .772

#12 BASKETBALL PUSH PASS (ONE HAND)

Objective. The objective of this test is to measure the ability to forcefully project a basketball against a wall by pushing the ball with one hand.

Equipment. Basketballs
Fast stop watches

Restraining line. 15'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we are interested in how fast you can push the basketball against the wall from behind this line (point to restraining line.) Be sure to push the ball this way (demonstrate) rather than throwing the ball like this (demonstrate). You may only use one hand. If you wish, you may take a step forward as you push the ball, as long as you stay behind the line. Remember that you should push the ball as fast as you can.

Instructions to timer. Start the watch when the ball leaves the hand. Stop the watch when the ball contacts the wall. Be absolutely certain that the student pushes the ball with one hand. If she throws the ball, or pushes with two hands, retake the trial.

Instructions to recorder. Note the wall height and record to the nearest foot. Record the time to the nearest hundredth of a second. Note the release height.

Number of trials. 6

Reliability. .829

#13 BASKETBALL ONE-HAND PUSH SHOT

Objective. The objective of this test is to measure the ability to forcefully project a basketball on or above a specified wall height, pushing with one hand.

Equipment. Basketballs
Fast stop watches

Restraining line. 15'

Minimum wall height. 10'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we are interested in how fast you can push a basketball from behind this line (point to restraining line) against the wall. The ball must contact the wall on or above the 10' mark on the wall. If the ball hits below that point, the trial must be repeated. The ball must be pushed, not thrown, with one hand. You may take a step forward if you wish, as long as you do not step over the line. Remember to push the ball as fast as you can.

Instructions to timer. Start the watch when the ball leaves the hand. Stop the watch when the ball contacts the wall.

Instructions to recorder. Be sure that the student pushes the ball. If the ball is brought in back of the shoulder, repeat the trial. In a properly executed push, the ball is kept in front of the body. Record the time and wall height. Note the release height.

Number of trials. 6

Reliability. .674

#14 BASKETBALL CHEST PASS (TWO-HAND)

Same as Basketball Push Pass, but with the use of two hands.

Reliability. **.829**

#15 BASKETBALL OVERHEAD PASS (TWO-HAND)

Objective. The objective of this test is to measure the ability to forcefully project a basketball against the wall by throwing the ball from an overhead position, using two hands.

Equipment. Basketballs
Fast stop watches

Restraining line. 20'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we want to know how fast you can throw a basketball from behind this line (point to restraining line) to the wall. You must use two hands to throw the ball. Also, the ball must be thrown from an overhead position -- like this (demonstrate). It does not matter whether you have ever played basketball before. Simply throw the ball as fast as you can. You may take a step forward as you throw the ball, as long as you remain in back of the restraining line. Remember that we are interested in how fast you can throw the ball.

Instructions to timer. Start the watch when the ball leaves the hands. Stop the watch when the ball contacts the wall. Be sure that the student uses two hands to execute the throw, and that she throws from an overhead position. If she fails to do either, retake the trial. Note the contact height.

Instructions to recorder. Note the wall height and record to the nearest foot. Record the time to the nearest hundredth of a second. Note the release height.

Number of trials. 6

Reliability. .653

#16 VOLLEYBALL CHEST PASS

Objective. The objective of this test is to measure the ability to forcefully project a volleyball against the wall using a chest pass.

Equipment. Volleyballs
Fast stop watches

Restraining line. 15'

Minimum wall height. 9'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we want to know how fast you can hit a volleyball from behind this line (point to restraining line) to the wall. You must toss the ball to yourself, and hit it against the wall with two hands. The ball must contact the wall on or above the 9' area. The ball must be hit in front of the body.

Instructions to timer. Start the watch when the hands contact (striking, not tossing) the ball. Stop the watch when the ball hits the wall. Be sure that the student hits with two hands, and that the ball is contacted in front of the body as opposed to overhead.

Instructions to recorder. Note the wall height and record it to the nearest foot. Record the time to the nearest hundredth of a second. Note the contact height.

Number of trials. 6

Reliability. .648

#17 VOLLEYBALL OVERHEAD PASS

Objective. The objective of this test is to measure the ability to forcefully project a volleyball against the wall using an overhead pass (2 hands).

Equipment. Volleyballs
Fast stop watches

Restraining line. 15'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we want to know how fast you can hit a volleyball from behind this line (point to restraining line) to the wall. You must toss the ball to yourself, and hit it against the wall with two hands. Also, the ball must be hit overhead. Do not hit with the fists. If you wish, you may take a step forward as long as you do not step on or over the restraining line. Remember that we are interested in how fast you can hit the ball.

Instructions to timer. Start the watch when the hands contact (strike, not toss) the ball. Stop the watch when the ball hits the wall. Be sure that the student hits the ball with two hands, and that the ball is contacted overhead -- as opposed to in front of the body.

Instructions to recorder. Note the wall height and record it to the nearest foot. Record the time to the nearest hundredth of a second. Note the contact height.

Number of trials. 6

Reliability. .768

#18 HOCKEY DRIVE

Objective. The objective of this test is to measure the ability to forcefully project a hockey ball, using a hockey stick.

Equipment. Hockey balls
Hockey sticks

Restraining line. 20'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we want to know how fast you can hit a hockey ball from behind this line (point to restraining line) to the wall. The ball should remain on the floor. You must stand facing the wall, with the toes of both feet pointed directly toward the wall. Your backswing must not be higher than your shoulder. You do not have to check the height of the backswing yourself. If your swing is too high, you will be asked to retake the trial. Remember that you should hit the ball as hard as you can.

Instructions to timer. Start the watch when the stick hits the ball. Stop the watch when the ball reaches the wall.

Instructions to recorder. Check the facing of the student. Be sure the toes of both feet are pointed toward the wall. If, in the backswing, the stick moves above the shoulder,* retake the trial. Record the time to the nearest hundredth of a second.

Number of trials. 6

Reliability. .555

* Physical Education teacher checked this.

#19 BASKETBALL UNDERARM PASS

Objective. The objective of this test is to measure the ability to forcefully project a basketball against the wall with two hands, using an underarm movement.

Equipment. Basketballs
Fast Stop watches

Restraining line. 20'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we are interested in how fast you throw a basketball against the wall. You must stand in a side stride stance (demonstrate), and throw the ball from between the legs (demonstrate). You must not step forward either during or after the throw. Remember that you should throw the ball as hard or as fast as you can.

Instructions to timer. Start the watch when the ball leaves the hands. As the ball contacts the wall, stop the watch. Note wall height.

Instructions to recorder. Record time and wall height. Be sure the student does not alter her stance, and that she throws with two hands from between the legs. Note contact height.

Number of trials. 6

Reliability. .644

#20 WALL VOLLEY

Objective. The objective of this test is to measure the ability to project a volleyball against a wall repeatedly, using two hands.

Equipment. Volleyballs
Fast stop watches

Restraining lines. 5' line on floor 3' from wall
10' line on wall 7 1/2' from floor

Personnel. Timer
Recorder

Instructions to subjects. In this test, we would like to know how many times you can hit a volleyball against the wall in a 30 second period of time. You must remain in back of the restraining line, and hit the ball above the line on the wall. If you step on the line, or hit on or under the line on the wall, that hit will not count. To get started, toss the ball to yourself. If the ball hits the floor or gets away from you, retrieve the ball and start again. Your score will be the number of good, but not necessarily consecutive, hits. You will be given the signal Ready, Go!. Do not stop until you hear the signal Stop!

Allow a brief practice trial, but do not time.

Instructions to timer. Give the signal Ready, Go!. Start the watch as you say Go!. At the end of 30 seconds, give the signal Stop!. Stop the watch as you say Stop!.

Instructions to recorder. Count the number of satisfactory hits. The score for each trial is the number of times the ball is clearly volleyed from behind the 5' line on the floor above the 10' line on the wall in the 30 seconds time interval. Record the number of hits.

Number of trials. 3

Reliability. .755

# 21 BOUNCE-DRIBBLE

Objective. The objective of this test is to measure the ability to project a basketball repeatedly against the floor as fast as possible for a specified number of times.

Equipment. Basketballs
Fast stop watches

Personnel. Timer
Recorder

Instructions to subjects. In this test, we want to know how many times you can bounce a basketball in five seconds. You should not move around while bouncing the ball. You may move one foot, but the other foot should remain in the same spot throughout the test. You will be given a signal Ready, Go!. You should begin bouncing the ball as fast as you can. You do not need to count the number of bounces. When you hear the signal Stop! you will know you have completed the test. Remember to bounce the ball as fast as you can.

Allow the student to practice a few bounces, but do not time.

Instructions to timer. Start the watch as you say Go!. At the end of five seconds, give the signal Stop! and stop the watch.

Instructions to recorder. When the ball hits the floor on the first bounce, begin counting. Count each time the ball hits the floor. Be certain not to count the hand hitting the ball, but rather the ball hitting the floor. Do not count any bounces after the signal 'Stop' is given. Record the number of bounces. See that the student does not move the pivot foot.

Number of trials. 4

Reliability. .842

# 22 BASKETBALL THROW AND CATCH

Objective. The objective of this test is to measure the ability to forcefully project a basketball repeatedly against a wall by throwing and catching with two hands.

Equipment. Basketballs
Fast stop watch

Restraining line. 10'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we are interested in how many times you can throw the basketball against the wall during a thirty second period. You must use two hands to throw and catch the ball. Also, you must remain in back of the restraining line while throwing and catching. Should your foot be on or over the restraining line as you throw, that throw will not count. You will be given a starting signal, Ready, Go!

Allow a brief practice time -- not timed.

Instructions to timer. Give the signal, Ready, Go! when the subjects are ready. Start the watch as you say Go! At the end of thirty seconds, stop the watch and simultaneously say Stop!

Instructions to recorder. Count the number of throws which the student executes from behind the restraining line during the thirty seconds. Any time the student steps on or over the restraining line, do not count that throw. Remind the student that she is on the line if she remains there. Record the number of satisfactory throws.

Number of trials. 4

Reliability. .699

#23 SOCCER PLACE-KICK

Objective. The objective of this test is to measure the ability to forcefully project a soccer ball by kicking the ball from a stationary position using one foot.

Equipment. Soccer balls
Fast stop watches

Restraining line. 30'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we want to know how fast you kick a soccer ball from behind this line (point to restraining line) to the wall. The ball will be stationary on the floor. You should kick it with the top of the instep of the foot. You may take one step forward, if you wish, before kicking the ball. Remember that you should kick the ball as hard as you can.

Instructions to timer. Start the watch when the foot contacts the ball. Stop the watch when the ball hits the wall.

Instructions to recorder. Be sure that the ball is kicked with the top of the instep. (The ball should be completely immobile before it is kicked.) Note the wall height to the nearest foot and record it. Record the time to the nearest hundredth of a second.

Number of trials. 6

Reliability. .718

#24 SOCCER PUNT

Objective. The objective of this test is to measure the ability to forcefully project a soccer ball by punting the ball.

Equipment. Soccer balls
Fast stop watches

Restraining line. 30'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we would like to see how fast you can kick the soccer ball from behind this line (point to restraining line) to the wall. You will begin with the ball held in your hands. The ball should be kicked from your hands. You may release the ball and then kick it, if you wish, but you should kick the ball before it touches the floor. The ball should remain in the air until it touches the wall. You may take one step, if you wish -- like this (demonstrate). Remember that you want to kick the ball as hard as you can.

Instructions to timer. As soon as the kicking foot contacts the ball, start the watch. Stop the watch when the ball contacts the wall. Note the wall height, and record to the nearest foot. Record the time. Note the contact height.

Number of trials. 6

Reliability. .751

#25 SOCCER PASS

Objective. The objective of this test is to measure the ability to forcefully project a soccer ball on the floor using the instep of the foot.

Equipment. Soccer balls
Fast stop watches

Restraining line. 30'

Personnel. Timer
Recorder

Instructions to subjects. In this test, we are interested in how fast you can kick a soccer ball from behind this line (point to restraining line) to the wall by using the instep of the foot. The ball should stay on or close to the floor. It does not matter whether you have ever kicked a ball this way before. Simply do the best you can. You will be allowed to take one step, if you wish -- like this (demonstrate). Remember that you want to kick the ball as hard as you can, and attempt to keep it on the floor.

Instructions to timer. As soon as the kicking foot contacts the ball, start the watch. Stop the watch when the ball contacts the wall.

Instructions to recorder. Be sure the kick is with the instep of the foot, and that the leg swings in the sagittal plane. If not, retake the trial. If the ball is kicked in the air, note the wall height, and record to the nearest foot. Record the time to the nearest hundredth of a second. Check all misses.

Number of trials. 6

Reliability. .790

APPENDIX B

Mean Scores

APPENDIX B

Mean Scores

Subject	Class	# 1 Softball Overarm Throw	# 2 Basketball Overarm Throw	# 3 Volleyball Overarm Serve
001	1	57.39	35.50	46.28
002	1	41.58	29.86	40.06
003	1	41.60	31.09	40.66
004	1	38.10	31.58	46.35
005	1	51.09	31.83	31.62
006	1	41.81	30.90	34.68
007	1	43.58	34.13	42.83
008	1	39.21	27.35	29.45
009	1	50.99	31.95	41.43
010	1	46.24	35.13	27.12
011	1	36.62	27.09	35.22
012	1	38.35	33.37	34.12
013	1	51.44	26.77	40.17
014	1	48.64	35.29	48.57
015	1	39.73	31.12	32.99
016	1	46.71	28.90	33.31
017	1	48.62	31.80	38.03
018	1	44.69	33.32	38.28
019	1	45.42	31.22	37.06
020	1	51.22	31.14	45.29
021	1	38.45	25.83	39.50
022	1	44.96	30.40	31.85
023	1	39.85	30.43	33.29
024	1	37.98	31.84	36.34
025	1	50.05	32.37	38.50
026	1	49.18	34.72	41.83
027	1	50.85	34.62	46.00
028	1	41.10	27.86	33.17
029	1	38.52	27.68	39.92
030	1	42.93	28.01	32.06
031	1	54.75	35.72	41.84
032	1	50.46	34.11	48.05
033	1	45.13	33.82	43.74
034	2	47.92	34.35	38.28
035	2	38.05	29.66	39.61

Mean Scores -- (Cont'd.)

Subject	Class	#1 Softball Overarm Throw	#2 Basketball Overarm Throw	#3 Volleyball Overarm Serve
036	2	42.24	31.14	26.61
037	2	45.06	30.67	29.46
038	2	50.53	33.12	39.75
039	2	44.70	34.05	37.11
040	2	47.17	30.58	30.28
041	2	41.23	32.04	36.89
042	2	54.77	34.30	34.41
043	2	53.29	34.82	35.83
044	2	54.15	29.59	36.13
045	2	30.70	29.62	27.24
046	2	45.54	29.88	30.25
047	2	35.03	31.58	32.37
048	2	33.36	30.21	29.44
049	2	47.73	30.04	35.59
050	2	56.31	30.48	46.27
051	2	41.50	28.18	38.62
052	2	46.57	29.26	29.78
053	2	43.08	31.97	27.33
054	2	36.62	33.33	29.18
055	2	54.20	35.82	40.64
056	2	40.96	30.70	37.30
057	2	43.32	32.59	28.71
058	2	48.91	31.43	31.22
059	2	47.22	29.17	30.29
060	2	46.18	28.71	29.81
061	2	55.61	35.32	34.45
062	2	42.03	30.16	29.88
063	2	41.37	29.74	28.45
064	2	43.17	28.67	35.45
065	2	45.44	30.82	30.65
066	2	39.36	30.48	30.69
067	2	41.34	31.53	27.83
068	4	52.00	28.61	38.19
069	4	48.58	33.70	41.42
070	4	43.44	28.83	48.59

Mean Scores -- (Cont'd.)

Subject	Class	# 1 Softball Overarm Throw	# 2 Basketball Overarm Throw	# 3 Volleyball Overarm Serve
071	4	50.28	32.16	39.01
072	4	38.55	31.44	27.32
073	4	43.17	32.79	39.28
074	4	43.46	31.46	38.83
075	4	45.93	37.72	40.91
076	4	37.63	28.03	44.50
077	4	60.05	41.75	47.27
078	4	40.42	27.98	44.84
079	4	41.24	31.22	30.34
080	4	48.64	29.36	29.25
081	4	43.54	30.73	45.68
082	4	53.17	33.65	35.95
083	4	50.78	33.29	33.02
084	4	47.28	29.16	45.34
085	4	33.69	29.74	37.26
086	4	39.97	26.97	32.21
087	4	58.20	32.63	38.40
088	4	42.38	27.33	32.18
089	4	39.35	29.33	36.82
090	4	44.59	36.12	37.88
091	4	44.06	31.26	30.21
092	4	55.89	34.46	41.59
093	4	34.80	27.76	37.33
094	4	48.32	33.79	42.85
095	4	33.50	26.91	30.83
096	4	49.12	32.49	31.20
097	4	44.06	28.60	43.01
098	4	41.28	30.72	29.50
099	4	50.54	40.01	37.01
100	4	43.96	30.29	36.99
101	4	43.83	31.96	40.34
102	5	43.53	32.22	44.16
103	5	56.35	32.29	37.80
104	5	43.71	34.62	39.88
105	5	33.57	28.91	28.16

Mean Scores -- (Cont'd.)

Subject	Class	# 1 Softball Overarm Throw	# 2 Basketball Overarm Throw	# 3 Volleyball Overarm Serve
106	5	30.88	31.63	30.70
107	5	51.20	33.90	53.54
108	5	57.73	37.39	43.95
109	5	37.92	27.27	35.47
110	5	51.28	33.73	37.62
111	5	59.32	33.81	51.61
112	5	41.28	34.53	33.67
113	5	39.52	32.14	35.16
114	5	52.88	35.41	43.00
115	5	37.72	27.70	38.89
116	5	38.85	29.57	31.23
117	5	36.33	31.09	32.19
118	5	42.80	31.37	42.94
119	5	49.50	33.89	31.53
120	5	50.74	33.70	49.79
121	5	43.63	32.39	35.44
122	5	40.93	31.84	27.92
123	5	42.49	28.60	41.95
124	5	44.52	35.69	34.61
125	5	46.39	32.01	34.09
126	5	45.12	29.30	35.75
127	5	51.12	30.60	34.00
128	5	51.49	43.65	36.28
129.	5	41.67	30.59	40.69
130	5	40.29	32.39	44.51
131	5	55.00	31.59	38.73
132	5	47.26	35.27	43.02
133	6	55.63	34.24	39.42
134	6	38.76	28.65	65.84
135	6	39.93	33.69	33.86
136	6	47.06	32.47	38.39
137	6	50.60	30.29	34.37
138	6	58.21	35.85	42.05
139	6	45.60	28.20	47.90

Mean Scores -- (Cont'd.)

Subject	Class	#1 Softball Overarm Throw	#2 Basketball Overarm Throw	#3 Volleyball Overarm Serve
141	6	41.84	33.53	36.18
142	6	53.81	38.93	63.25
143	6	51.83	34.66	42.14
144	6	50.67	31.65	36.49
145	6	39.00	31.85	43.11
146	6	39.68	29.26	40.34
147	6	51.60	38.58	43.18
148	6	48.81	34.00	29.72
149	6	48.93	29.56	57.83
150	6	47.10	31.34	35.81
151	6	50.18	33.92	39.59
152	6	36.78	31.17	31.62
153	6	44.80	31.40	40.04
154	6	56.15	35.85	49.00
155	6	50.71	36.08	57.32
156	6	37.28	33.43	41.88
157	6	47.41	35.83	34.73
158	6	37.45	30.76	38.85
159	6	44.16	30.03	47.29
160	6	34.36	29.99	25.24
161	6	43.25	31.64	52.12
162	6	36.55	28.89	41.12
163	6	44.52	28.27	33.84
164	6	41.10	29.87	37.22
165	6	44.32	31.83	36.06
166	6	51.15	32.61	31.23
167	6	52.21	39.88	38.53

Mean Scores -- (Cont'd.)

Subject	Class	#4 Tennis Serve	#5 Badminton Clear	#6 Bowling	#7 Softball Underarm Throw
001	1	118.88	78.51	2.99	47.30
002	1	51.89	55.96	2.95	47.55
003	1	63.93	62.07	2.78	46.13
004	1	64.71	60.90	2.66	36.51
005	1	43.79	55.28	2.49	46.96
006	1	61.04	62.45	2.77	43.79
007	1	81.42	52.63	2.45	37.26
008	1	49.57	57.61	2.81	41.53
009	1	92.74	56.94	2.23	49.26
010	1	62.09	54.60	3.12	42.54
011	1	52.16	43.96	3.51	40.35
012	1	56.42	45.61	3.19	34.01
013	1	55.81	64.06	3.50	47.53
014	1	61.27	63.60	2.49	45.65
015	1	70.00	54.57	2.97	42.72
016	1	67.90	71.41	2.63	40.32
017	1	68.19	63.21	2.58	42.36
018	1	59.86	68.02	2.26	42.44
019	1	61.40	56.16	2.34	40.13
020	1	67.16	50.31	2.63	43.90
021	1	56.09	49.32	4.30	37.76
022	1	61.30	60.11	2.71	40.16
023	1	49.83	43.55	3.05	42.34
024	1	72.81	63.85	2.84	36.84
025	1	92.20	64.57	2.46	44.40
026	1	81.23	75.10	2.23	49.28
027	1	62.97	61.94	2.81	42.47
028	1	80.21	72.77	2.36	50.52
029	1	54.56	45.09	3.51	37.80
030	1	60.49	51.17	2.92	36.25
031	1	79.84	78.86	2.77	51.30
032	1	79.57	59.89	2.63	43.12
033	1	68.83	67.26	2.80	46.41
034	2	64.62	67.60	2.33	43.68
035	2	54.14	65.71	3.19	42.62

Mean Scores -- (Cont'd.)

Subject	Class	# 4 Tennis Serve	# 5 Badminton Clear	# 6 Bowling	# 7 Softball Underarm Throw
036	2	45.75	48.48	2.47	35.82
037	2	57.79	60.34	2.71	37.44
038	2	58.16	66.30	2.99	37.82
039	2	62.55	71.55	2.41	40.01
040	2	59.38	59.28	3.37	38.50
041	2	61.18	73.79	2.92	34.25
042	2	73.26	71.47	2.56	46.38
043	2	69.68	74.10	3.02	44.77
044	2	56.29	59.76	2.42	37.31
045	2	60.62	60.66	2.88	30.17
046	2	58.41	49.95	3.06	41.36
047	2	60.15	51.89	2.93	33.86
048	2	56.68	64.45	2.84	31.56
049	2	77.02	74.93	2.66	41.37
050	2	69.01	66.66	2.27	42.69
051	2	54.75	33.69	2.61	41.62
052	2	57.52	59.64	3.06	46.40
053	2	70.68	55.48	2.84	30.90
054	2	67.00	61.99	2.31	41.95
055	2	86.00	77.23	2.31	44.71
056	2	52.22	54.20	2.62	34.65
057	2	54.45	58.75	3.06	40.99
058	2	70.02	79.19	2.41	36.31
059	2	68.03	78.78	2.37	34.58
060	2	55.35	55.16	2.82	43.88
061	2	72.59	62.22	2.22	37.67
062	2	68.78	63.90	2.91	41.55
063	2	59.20	72.87	3.24	35.61
064	2	53.11	54.71	3.04	30.23
065	2	63.50	49.28	3.14	37.98
066	2	54.97	55.74	3.84	34.25
067	2	59.29	52.44	2.45	39.22
068	4	72.10	81.21	2.58	37.59
069	4	61.83	54.04	2.87	43.79
070	4	55.53	59.40	2.93	46.71

Mean Scores -- (Cont'd.)

Subject	Class	#4 Tennis Serve	#5 Badminton Clear	#6 Bowling	#7 Softball Underarm Throw
071	4	76.44	67.72	3.16	41.35
072	4	63.61	60.60	2.88	42.91
073	4	64.83	69.42	3.22	40.18
074	4	54.96	59.05	2.23	39.80
075	4	64.90	85.05	2.55	44.04
076	4	60.23	57.60	3.39	44.49
077	4	73.70	71.25	2.48	46.78
078	4	48.30	60.64	3.28	43.51
079	4	62.58	66.07	2.67	44.31
080	4	69.44	62.08	2.77	42.36
081	4	53.83	65.32	2.64	39.26
082	4	76.99	91.10	2.23	41.76
083	4	70.92	72.31	2.66	49.35
084	4	58.73	55.75	3.30	41.18
085	4	46.92	51.41	2.86	36.74
086	4	56.72	63.33	3.39	37.30
087	4	65.94	56.04	3.10	44.54
088	4	60.77	56.59	2.70	40.50
089	4	51.66	52.80	3.73	32.85
090	4	63.04	57.08	3.10	41.12
091	4	58.92	57.46	2.76	41.66
092	4	79.73	80.24	2.44	42.87
093	4	61.45	60.45	3.00	47.01
094	4	56.52	57.57	3.11	45.85
095	4	61.82	64.20	3.86	39.54
096	4	64.93	60.60	2.57	46.78
097	4	53.54	52.89	2.47	44.94
098	4	53.73	58.15	3.30	39.73
099	4	58.70	51.95	3.77	40.96
100	4	71.25	63.34	2.57	39.20
101	4	62.18	61.12	2.69	40.61
102	5	67.55	67.43	2.87	41.32
103	5	63.93	69.40	2.72	40.99
104	5	67.84	68.04	2.44	46.67
105	5	57.21	57.25	3.36	35.14

Mean Scores -- (Cont'd.)

Subject	Class	# 4 Tennis Serve	# 5 Badminton Clear	# 6 Bowling	# 7 Softball Underarm Throw
106.	5	52.85	49.02	3.09	37.71
107	5	76.93	73.27	2.39	44.15
108	5	59.98	72.20	3.01	40.38
109	5	68.20	59.45	2.70	38.77
110	5	68.22	71.78	3.01	47.20
111	5	67.60	74.00	2.10	46.54
112	5	69.06	64.72	2.63	37.07
113	5	62.98	67.29	2.57	46.14
114	5	56.76	64.46	2.24	42.65
115	5	56.24	65.54	2.81	39.80
116	5	42.90	54.02	3.62	35.76
117	5	48.00	50.30	3.45	35.12
118	5	57.75	71.64	2.72	36.21
119	5	74.77	79.45	3.00	49.28
120	5	57.22	67.23	2.43	46.24
121	5	67.50	61.31	2.99	40.25
122	5	65.36	70.17	3.22	38.40
123	5	49.64	63.97	2.82	37.47
124	5	65.93	61.38	2.99	47.77
125	5	84.49	66.57	2.40	44.83
126	5	52.72	62.47	2.88	44.43
127	5	52.94	62.52	3.33	37.46
128	5	61.05	69.34	2.77	44.39
129	5	76.20	63.65	3.12	38.64
130	5	56.03	65.53	3.50	41.12
131	5	59.37	72.79	2.74	43.10
132	5	59.05	70.84	2.62	33.24
133	6	78.82	69.04	2.26	42.67
134	6	51.75	51.27	3.46	40.09
135	6	51.12	56.27	3.55	37.74
136	6	48.98	63.25	3.40	46.32
137	6	62.42	68.55	2.65	33.80
138	6	64.74	75.84	3.11	35.91
139	6	77.01	66.97	2.74	41.99

Mean Scores -- (Cont'd.)

Subject	Class	#4 Tennis Serve	#5 Badminton Clear	#6 Bowling	#7 Softball Underarm Throw
141	6	58.81	53.99	3.30	41.19
142	6	73.75	78.92	2.40	43.65
143	6	67.74	73.26	2.71	45.70
144	6	54.72	55.78	2.96	34.30
145	6	58.00	47.60	2.46	34.96
146	6	69.48	71.49	3.35	48.33
147	6	84.60	74.27	2.65	41.75
148	6	55.16	58.21	3.20	35.81
149	6	72.81	76.77	2.59	46.21
150	6	62.36	56.44	2.43	41.59
151	6	71.22	67.87	2.53	46.14
152	6	45.57	52.83	2.64	36.33
153	6	65.85	64.80	3.04	39.89
154	6	85.00	70.21	2.47	40.06
155	6	72.17	95.80	2.64	40.24
156	6	55.71	53.06	3.41	29.77
157	6	80.58	70.03	3.04	50.17
158	6	54.98	57.20	3.02	38.73
159	6	57.56	58.63	3.57	33.54
160	6	54.80	59.45	3.91	33.07
161	6	61.42	61.59	3.82	37.81
162	6	51.01	55.08	2.89	36.44
163	6	63.67	60.42	2.90	39.50
164	6	75.36	55.81	3.02	34.47
165	6	60.04	57.28	2.72	40.49
166	6	84.83	73.02	3.36	39.02
167	6	72.43	68.04	2.38	36.43

Mean Scores -- (Cont'd.)

Subject	Class	#8 Volleyball Underarm Serve	#9 Badminton Serve	#10 Tennis Drive	#11 Volleyball Sidearm Serve
001	1	39.85	58.17	64.71	33.94
002	1	29.29	39.01	49.53	29.98
003	1	30.49	39.26	68.77	40.21
004	1	30.03	42.83	54.72	41.68
005	1	24.10	35.66	52.14	49.52
006	1	30.87	57.98	56.93	36.05
007	1	36.20	51.50	72.34	35.70
008	1	26.80	38.24	53.96	39.08
009	1	32.99	72.64	84.25	42.66
010	1	29.70	40.06	51.50	34.55
011	1	26.18	42.77	56.66	32.48
012	1	30.12	39.98	64.16	42.32
013	1	28.34	34.24	57.81	39.90
014	1	32.40	44.74	57.01	35.55
015	1	31.77	43.62	64.34	33.46
016	1	32.49	51.98	53.67	38.81
017	1	30.35	43.92	66.20	34.47
018	1	31.85	61.67	52.29	44.57
019	1	29.21	46.78	65.17	37.29
020	1	33.81	60.78	70.65	40.52
021	1	26.42	29.93	40.32	24.72
022	1	29.42	51.84	54.47	41.78
023	1	35.69	38.69	68.92	37.37
024	1	32.84	41.09	66.98	38.22
025	1	41.30	55.90	54.62	49.97
026	1	39.73	76.99	76.40	36.02
027	1	28.81	35.93	73.31	34.71
028	1	41.49	51.17	64.34	44.31
029	1	26.63	51.66	62.30	31.52
030	1	30.47	35.79	52.23	32.25
031	1	32.86	41.36	66.90	45.54
032	1	34.91	53.56	69.21	40.47
033	1	27.67	48.48	68.85	32.37
034	2	40.81	49.61	66.36	42.23
035	2	26.73	43.48	61.07	36.76

Mean Scores -- (Cont'd.)

Subject	Class	# 8 Volleyball Underarm Serve	# 9 Badminton Serve	# 10 Tennis Drive	# 11 Volleyball Sidearm Serve
036	2	24.72	46.76	51.21	42.80
037	2	31.95	42.52	46.97	29.29
038	2	30.97	53.11	57.68	39.08
039	2	28.76	50.39	79.13	57.22
040	2	30.01	43.15	57.40	30.98
041	2	30.94	43.83	55.31	45.32
042	2	29.37	60.09	51.60	45.88
043	2	34.54	51.88	57.08	36.79
044	2	25.81	47.51	51.26	35.27
045	2	29.07	43.74	48.01	29.42
046	2	30.35	43.96	55.85	32.06
047	2	30.02	35.30	46.33	36.77
048	2	28.97	48.11	49.12	43.54
049	2	26.37	37.14	65.51	33.56
050	2	31.87	50.57	69.89	47.42
051	2	23.73	42.04	50.31	32.95
052	2	28.42	48.19	59.13	34.85
053	2	32.65	52.19	59.23	30.98
054	2	32.80	53.98	50.42	31.08
055	2	30.61	57.20	60.91	41.46
056	2	29.89	45.88	62.99	34.39
057	2	37.52	50.17	52.20	35.66
058	2	33.73	63.39	63.51	39.78
059	2	33.07	47.25	54.53	32.10
060	2	33.60	47.87	46.18	37.51
061	2	34.42	48.64	61.63	39.90
062	2	27.69	47.31	57.36	38.35
063	2	25.50	38.91	52.55	39.37
064	2	24.68	45.53	50.01	32.49
065	2	25.42	48.65	45.00	38.59
066	2	25.52	63.69	47.73	31.75
067	2	31.93	43.32	57.45	40.96
068	4	34.73	56.14	82.32	38.08
069	4	32.94	54.27	58.92	39.96
070	4	28.41	45.08	63.32	34.65

Mean Scores -- (Cont'd.)

Subject	Class	# 8 Volleyball Underarm Serve	# 9 Badminton Serve	# 10 Tennis Drive	# 11 Volleyball Sidearm Serve
071	4	28.32	46.05	64.33	37.19
072	4	28.88	51.05	59.89	30.56
073	4	23.61	44.95	47.12	30.88
074	4	29.08	45.00	79.73	43.27
075	4	33.93	53.45	67.43	41.24
076	4	27.17	30.94	37.54	29.42
077	4	36.28	44.54	64.19	41.05
078	4	25.73	32.84	55.17	44.22
079	4	34.82	38.94	67.16	38.53
080	4	30.89	47.26	58.70	37.26
081	4	26.71	46.59	55.79	35.09
082	4	29.92	55.14	82.62	45.10
083	4	31.43	47.76	56.58	27.46
084	4	29.66	52.22	62.41	39.75
085	4	23.80	44.94	50.02	31.33
086	4	28.08	47.76	65.02	32.04
087	4	30.68	42.58	58.20	32.05
088	4	44.20	53.20	64.27	37.44
089	4	23.83	34.17	45.19	25.90
090	4	35.43	47.74	67.67	43.51
091	4	33.60	46.35	54.76	42.16
092	4	32.44	63.54	68.20	47.24
093	4	20.93	37.61	49.46	24.64
094	4	29.52	45.17	52.51	37.63
095	4	24.29	37.02	57.08	39.42
096	4	29.58	53.22	53.93	33.33
097	4	32.69	55.13	94.07	39.80
098	4	29.82	41.53	57.63	31.56
099	4	30.90	40.23	83.63	38.22
100	4	32.12	53.23	78.34	39.35
101	4	33.14	48.81	64.09	41.66
102	5	26.82	40.72	58.01	33.67
103	5	32.85	49.50	67.13	41.85
104	5	36.14	50.42	61.50	35.05
105	5	27.84	50.15	46.14	29.53

Mean Scores -- (Cont'd.)

Subject	Class	#8 Volleyball Underarm Serve	#9 Badminton Serve	#10 Tennis Drive	#11 Volleyball Sidearm Serve
106	5	31.50	38.74	51.37	27.69
107	5	28.99	50.04	69.21	37.92
108	5	33.11	60.85	57.30	35.91
109	5	34.62	36.26	55.31	34.22
110	5	40.08	37.35	56.58	35.84
111	5	35.90	59.68	78.73	40.61
112	5	28.15	52.98	55.87	30.30
113	5	28.47	42.85	57.47	41.20
114	5	35.59	59.40	54.83	28.34
115	5	33.13	45.78	61.37	29.98
116	5	29.20	39.35	56.75	28.88
117	5	28.09	34.62	51.29	30.50
118	5	28.17	50.65	63.59	32.71
119	5	39.12	45.50	64.15	43.42
120	5	31.64	51.09	75.47	36.59
121	5	29.85	49.38	62.96	33.50
122	5	34.93	38.27	51.78	41.13
123	5	24.06	51.36	65.16	37.25
124	5	37.22	46.88	62.90	40.53
125	5	38.45	54.24	64.82	35.20
126	5	26.77	52.06	60.87	36.74
127	5	27.43	44.92	54.37	34.92
128	5	29.56	47.18	54.77	37.57
129	5	30.88	49.22	70.76	38.36
130	5	25.86	49.11	57.51	39.25
131	5	35.60	42.02	76.04	40.93
132	5	35.29	58.05	72.57	39.84
133	6	34.97	43.30	67.99	40.34
134	6	23.03	30.92	44.36	26.60
135	6	32.25	48.55	61.36	29.80
136	6	27.55	46.77	53.39	31.98
137	6	29.67	42.87	51.74	31.72
138	6	32.95	55.55	58.21	47.87
139	6	37.67	57.10	76.29	41.88

Mean Scores -- (Cont'd.)

Subject	Class	#8 Volleyball Underarm Serve	#9 Badminton Serve	#10 Tennis Drive	#11 Volleyball Sidearm Serve
141	6	31.19	47.71	56.64	32.41
142	6	37.59	43.81	68.06	43.52
143	6	31.98	56.29	75.40	38.24
144	6	26.59	38.59	73.07	40.51
145	6	25.63	46.62	52.67	36.37
146	6	29.51	56.28	70.97	31.86
147	6	32.29	48.99	69.71	33.97
148	6	22.94	40.34	60.18	31.04
149	6	32.95	43.03	61.89	35.88
150	6	31.65	54.68	52.69	46.35
151	6	35.46	73.22	67.41	35.04
152	6	30.84	37.27	58.24	37.79
153	6	29.97	53.51	55.92	30.41
154	6	41.60	52.56	60.53	38.22
155	6	44.84	57.93	84.35	42.97
156	6	28.14	37.09	54.17	34.12
157	6	35.77	51.28	59.96	45.36
158	6	30.20	43.56	50.17	34.99
159	6	26.97	43.49	53.16	30.85
160	6	23.17	40.02	57.33	24.98
161	6	26.41	34.63	50.58	35.77
162	6	24.83	40.00	52.94	27.15
163	6	26.68	51.51	59.31	26.92
164	6	32.72	49.20	38.47	37.51
165	6	29.88	51.20	56.78	40.58
166	6	29.35	40.46	56.30	42.34
167	6	31.09	40.28	54.00	40.00

Mean Scores -- (Cont'd.)

Subject	Class	#12 Basketball 1-hand Push Pass	#13 Basketball Push Shot	#14 Basketball Chest Pass	#15 Basketball Overhead Pass
001	1	36.46	20.75	34.41	31.58
002	1	24.14	21.17	26.61	29.62
003	1	28.29	21.14	29.01	33.72
004	1	31.94	21.56	31.65	32.51
005	1	26.43	22.54	28.35	29.55
006	1	29.46	20.87	28.27	33.48
007	1	26.97	21.73	31.17	34.04
008	1	27.43	22.15	31.64	27.04
009	1	29.15	22.64	29.01	34.31
010	1	37.18	23.30	30.54	32.19
011	1	28.08	21.08	28.68	29.62
012	1	30.90	21.19	32.51	31.62
013	1	31.85	23.06	34.67	30.87
014	1	27.52	21.12	24.49	31.59
015	1	25.25	20.66	24.70	29.96
016	1	32.63	21.44	29.74	35.87
017	1	33.05	24.14	31.69	31.20
018	1	29.41	20.26	28.87	31.50
019	1	30.75	22.66	25.59	31.94
020	1	35.51	24.36	36.87	34.10
021	1	25.94	21.33	25.85	29.40
022	1	28.45	20.58	28.12	28.83
023	1	27.33	20.73	26.79	33.67
024	1	27.60	21.34	29.23	32.46
025	1	28.16	21.96	27.42	32.27
026	1	33.94	25.88	28.24	35.38
027	1	27.13	22.05	29.75	32.79
028	1	35.00	22.00	28.41	35.50
029	1	28.39	21.99	32.19	24.89
030	1	24.98	20.09	22.66	29.24
031	1	30.62	24.54	33.17	37.35
032	1	30.33	22.95	29.22	29.65
033	1	28.33	22.16	26.49	30.72
034	2	34.86	23.49	31.60	33.92
035	2	28.37	21.77	28.96	34.12

Mean Scores -- (Cont'd.)

Subject	Class	# 12 Basketball 1-hand Push Pass	# 13 Basketball Push Shot	# 14 Basketball Chest Pass	# 15 Basketball Overhead Pass
036	2	27.41	21.16	33.66	31.83
037	2	30.68	19.86	34.31	30.57
038	2	29.15	22.27	32.95	26.16
039	2	37.20	25.11	29.52	29.65
040	2	33.92	20.10	28.60	29.33
041	2	32.13	20.16	26.73	36.97
042	2	30.65	22.29	30.60	34.84
043	2	28.31	20.45	33.59	30.41
044	2	25.38	18.94	27.31	28.51
045	2	26.97	21.00	28.91	30.73
046	2	30.11	22.34	33.67	27.88
047	2	30.16	19.94	28.30	29.09
048	2	30.99	22.15	33.41	34.18
049	2	32.79	20.69	31.91	29.17
050	2	26.94	21.44	27.90	26.86
051	2	23.36	21.35	29.45	25.35
052	2	29.55	21.43	26.65	29.14
053	2	27.40	23.88	25.82	28.39
054	2	33.24	23.76	29.89	29.65
055	2	28.88	21.96	28.21	33.48
056	2	29.04	21.34	33.62	32.54
057	2	31.38	25.76	39.55	30.98
058	2	29.39	23.18	30.29	28.69
059	2	30.44	21.87	28.47	32.71
060	2	28.43	23.20	30.94	29.20
061	2	27.43	23.01	30.69	25.72
062	2	30.46	22.63	28.94	31.55
063	2	27.70	23.68	25.06	27.02
064	2	28.85	19.72	27.69	27.31
065	2	29.02	20.75	30.07	27.19
066	2	26.91	23.05	26.43	27.43
067	2	28.23	20.04	29.33	25.45
068	4	31.55	20.48	27.48	27.61
069	4	27.55	21.32	29.61	30.95
070	4	27.97	20.49	33.50	26.07

Mean Scores -- (Cont'd.)

Subject	Class	#12 Basketball 1-hand Pass	#13 Basketball Push Shot	#14 Basketball Chest Pass	#15 Basketball Overhead Pass
071	4	26.52	19.21	24.74	30.12
072	4	25.57	20.31	26.54	28.80
073	4	27.28	21.32	31.83	29.53
074	4	33.23	21.26	36.95	32.25
075	4	33.07	21.95	31.15	32.31
076	4	28.27	19.50	28.37	26.97
077	4	36.14	21.94	42.95	27.20
078	4	25.12	23.37	30.43	27.90
079	4	28.46	19.81	33.41	29.90
080	4	22.09	20.58	30.92	30.03
081	4	26.00	22.54	26.44	28.72
082	4	28.57	22.36	33.10	32.98
083	4	31.11	18.74	33.74	30.83
084	4	32.47	20.66	34.27	31.82
085	4	27.45	22.70	30.20	29.99
086	4	30.86	20.04	31.23	26.19
087	4	21.14	20.84	31.50	32.55
088	4	28.98	21.30	41.10	27.27
089	4	26.32	22.04	29.27	30.30
090	4	27.98	22.86	30.45	33.07
091	4	33.85	21.02	37.79	26.57
092	4	31.25	22.45	33.64	32.23
093	4	24.02	19.63	31.90	29.60
094	4	28.91	21.48	27.47	30.24
095	4	23.14	20.14	26.68	26.98
096	4	30.69	20.23	30.43	32.13
097	4	27.40	21.41	31.66	28.46
098	4	22.81	19.04	25.65	29.83
099	4	33.85	23.15	30.72	33.14
100	4	29.25	21.89	30.39	31.03
101	4	29.82	20.99	26.84	30.21
102	5	29.73	22.43	31.18	29.87
103	5	33.70	22.54	32.98	30.69
104	5	33.68	21.21	34.25	29.86
105	5	30.15	21.41	32.47	27.24

Mean Scores -- (Cont'd.)

Subject	Class	#12 Basketball 1-hand Pass	#13 Basketball Push Shot	#14 Basketball Chest Pass	#15 Basketball Overhead Pass
106	5	28.21	20.48	30.00	30.64
107	5	31.61	23.58	37.93	29.28
108	5	38.45	22.61	36.19	34.69
109	5	32.43	19.84	36.33	30.34
110	5	30.50	21.83	32.34	29.40
111	5	35.00	21.00	36.50	33.23
112	5	29.15	19.27	32.61	31.66
113	5	30.95	20.69	34.28	31.84
114	5	30.78	19.95	35.10	33.27
115	5	28.61	21.56	28.51	27.43
116	5	30.61	20.34	32.10	28.59
117	5	30.95	19.86	31.76	30.80
118	5	30.11	19.42	31.38	29.30
119	5	33.26	21.19	36.32	35.11
120	5	30.26	22.52	32.54	28.71
121	5	29.50	20.22	30.23	33.02
122	5	38.06	20.75	40.12	31.63
123	5	30.69	21.17	34.78	28.87
124	5	32.99	21.97	29.94	27.64
125	5	29.80	22.15	32.89	31.44
126	5	32.92	20.55	36.76	33.04
127	5	29.64	21.27	33.79	34.49
128	5	32.33	21.43	37.05	34.79
129	5	31.22	22.25	31.06	36.06
130	5	25.82	20.28	30.89	30.65
131	5	32.44	22.98	33.91	30.60
132	5	26.40	20.57	32.05	28.20
133	6	28.97	23.91	28.96	30.60
134	6	30.07	20.68	27.08	28.19
135	6	36.26	23.56	32.01	29.34
136	6	27.33	22.27	29.37	31.37
137	6	25.82	22.59	28.72	32.73
138	6	30.05	23.21	34.93	32.31
139	6	31.37	22.75	30.67	31.31

Mean Scores -- (Cont'd.)

Subject	Class	# 12 Basketball 1-hand Pass	# 13 Basketball Push Shot	# 14 Basketball Chest Pass	# 14 Basketball Overhead Pass
141	6	32.71	21.12	27.19	28.62
142	6	36.25	24.51	29.30	36.44
143	6	29.86	27.72	31.76	33.43
144	6	33.18	21.25	30.02	29.12
145	6	29.73	22.59	26.60	30.16
146	6	31.76	22.72	31.81	31.20
147	6	27.59	25.66	28.33	30.78
148	6	30.78	22.27	28.94	30.93
148	6	29.64	22.23	30.49	36.18
150	6	27.43	21.82	32.27	32.04
151	6	28.76	19.76	26.43	26.71
152	6	33.19	21.83	30.72	29.91
153	6	29.59	21.42	30.41	31.10
154	6	33.95	28.27	33.16	31.73
155	6	32.89	22.19	30.74	32.88
156	6	34.29	21.96	27.50	29.69
157	6	33.75.	22.89	34.37	34.93
158	6	31.18	22.86	31.77	30.41
159	6	30.43	20.60	28.90	24.52
160	6	28.20	21.54	28.76	31.07
161	6	32.08	21.90	31.31	33.55
162	6	27.38	20.41	27.45	32.23
163	6	23.88	21.81	28.12	28.74
164	6	29.72	22.78	29.05	27.61
165	6	26.66	21.15	26.49	32.39
166	6	26.58	23.48	29.34	33.87
167	6	26.60	22.36	28.21	35.58

Mean Scores -- (Cont'd.)

Subject	Class	# 16 Volleyball Chest Pass	# 17 Volleyball Overhead Pass	# 18 Hockey Drive	# 19 Basketball Underarm Pass	# 20 Wall Volley
001	1	20.65	29.55	.66	26.37	25
002	1	19.36	24.63	.98	26.02	12
003	1	20.25	25.21	1.18	23.68	24
004	1	20.33	28.10	.99	31.87	17
005	1	21.14	24.08	.80	28.02	27
006	1	19.76	26.31	.83	23.73	37
007	1	21.11	30.80	.86	28.09	29
008	1	21.10	26.15	.95	21.16	20
009	1	20.43	25.33	.70	29.43	26
010	1	20.44	25.95	.66	29.82	25
011	1	20.58	28.57	1.03	24.62	28
012	1	21.50	24.41	1.07	25.03	26
013	1	21.37	24.87	.81	30.14	21
014	1	18.93	31.50	.75	25.40	21
015	1	19.35	28.83	.93	28.63	14
016	1	20.95	24.83	.89	24.43	16
017	1	22.14	24.96	.71	30.66	22
018	1	19.40	21.60	.79	31.71	24
019	1	20.76	27.05	.86	34.54	19
020	1	21.35	31.83	.88	24.00	23
021	1	19.00	22.53	1.14	29.01	10
022	1	20.01	24.83	.82	22.88	21
023	1	19.45	23.92	1.03	22.17	22
024	1	20.75	27.50	.93	28.49	20
025	1	20.69	28.19	.66	24.81	20
026	1	23.37	25.79	.61	25.01	31
027	1	20.46	29.68	.86	27.47	27
028	1	19.00	24.81	.80	30.24	21
029	1	19.29	22.74	.95	25.78	13
030	1	18.75	28.39	.88	26.96	13
031	1	19.02	40.50	.88	30.93	26
032	1	22.64	26.38	.83	28.82	26
033	1	20.69	26.70	.70	28.97	17
034	2	20.97	34.75	.73	25.87	32
035	2	20.31	30.32	.81	28.99	25

Mean Scores -- (Cont'd.)

Subject	Class	#16 Volleyball Chest Pass	#17 Volleyball Overhead Pass	#18 Hockey Drive	#19 Basketball Underarm Pass	#20 Wall Volley
036	2	21.32	27.53	1.01	29.47	14
037	2	19.02	25.58	1.03	23.68	29
038	2	19.22	27.93	.80	28.98	19
039	2	20.47	27.25	.61	25.32	19
040	2	20.56	23.32	.99	25.27	24
041	2	18.95	27.95	.83	27.14	25
042	2	17.63	30.54	.67	28.82	22
043	2	21.33	31.47	1.04	29.04	25
044	2	18.30	19.77	.88	25.10	15
045	2	19.09	25.83	.95	23.50	17
046	2	20.33	25.29	.75	28.15	17
047	2	19.79	21.25	.80	26.51	10
048	2	18.87	22.65	.67	23.29	21
049	2	20.05	27.47	.78	27.55	17
050	2	19.64	24.90	.70	22.92	22
051	2	17.96	22.15	.82	26.34	19
052	2	21.36	27.89	.91	25.76	34
053	2	19.67	23.38	.81	24.35	20
054	2	22.10	25.00	.73	26.95	29
055	2	21.02	24.09	.91	26.51	23
056	2	21.29	28.65	1.01	27.23	19
057	2	20.31	27.78	.93	28.92	10
058	2	21.47	23.50	.84	27.74	23
059	2	20.16	30.49	.96	24.64	24
060	2	20.07	27.09	.81	26.55	19
061	2	21.21	25.57	.73	23.73	33
062	2	22.44	24.35	.83	27.45	26
063	2	19.87	24.06	1.03	26.64	11
064	2	23.24	24.09	.98	22.83	09
065	2	18.52	24.02	.81	27.85	10
066	2	20.91	22.80	1.11	23.67	16
067	2	20.10	28.77	.84	22.73	23
068	4	19.70	23.96	.73	26.56	29
069	4	19.69	31.65	.83	23.04	31
070	4	18.94	26.04	.73	28.62	18

Mean Scores -- (Cont'd.)

Subject	Class	# 16 Volleyball Chest Pass	# 17 Volleyball Overhead Pass	# 18 Hockey Drive	# 19 Basketball Underarm Pass	# 20 Wall Volley
071	4	20.83	26.62	.81	26.69	14
072	4	19.61	26.74	.70	26.69	22
073	4	18.76	21.87	.84	27.33	19
074	4	21.85	27.86	.53	25.62	20
075	4	22.41	29.53	.71	28.23	27
076	4	18.32	23.21	1.06	27.17	19
077	4	25.01	33.80	.73	28.44	34
078	4	20.16	25.27	.80	26.58	19
079	4	19.84	27.63	.73	27.38	24
080	4	20.61	27.44	.76	25.65	13
081	4	19.38	24.51	.66	26.80	20
082	4	20.96	28.25	1.06	27.12	29
083	4	20.62	26.88	.78	23.94	25
084	4	19.26	26.59	.59	27.25	30
085	4	19.46	26.76	.80	25.33	16
086	4	20.08	25.59	1.26	27.06	22
087	4	19.08	28.03	.83	25.76	18
088	4	19.02	21.62	.92	27.58	17
089	4	21.35	26.52	1.07	24.27	08
090	4	23.98	27.09	.81	25.86	27
091	4	21.73	22.45	.73	26.98	14
092	4	20.80	31.87	1.15	27.96	28
093	4	19.96	22.34	1.27	23.93	19
094	4	20.46	23.05	.75	25.79	23
095	4	24.94	30.72	.68	24.32	13
096	4	20.27	23.48	.74	27.91	28
097	4	21.09	26.67	.91	29.67	26
098	4	19.49	22.36	1.08	24.76	19
099	4	20.98	28.47	.66	30.99	25
100	4	19.48	28.16	.72	28.77	31
101	4	21.48	32.31	.81	26.10	32
102	5	16.99	25.59	1.08	25.95	23
103	5	19.72	28.52	.84	29.26	26
104	5	19.51	20.93	.82	30.76	21
105	5	22.27	22.07	.95	26.41	18

Mean Scores -- (Cont'd.)

Subject	Class	#16 Volleyball Chest Pass	#17 Volleyball Overhead Pass	#18 Hockey Drive	#19 Basketball Underarm Pass	#20 Wall Volley
106	5	20.07	22.13	.86	28.71	13
107	5	20.23	28.09	.83	26.00	26
108	5	20.78	31.10	.74	26.68	28
109	5	18.38	23.22	1.02	21.68	18
110	5	21.63	29.56	.76	25.53	25
111	5	21.30	28.55	.70	31.42	30
112	5	21.01	25.51	.77	26.51	31
113	5	20.01	22.20	.71	24.93	17
114	5	19.82	28.51	.68	27.80	24
115	5	20.99	24.26	1.13	25.73	16
116	5	20.49	29.46	.81	25.53	25
117	5	20.36	24.55	1.13	24.48	18
118	5	19.58	22.72	.80	26.38	27
119	5	19.89	30.58	.84	26.52	18
120	5	21.27	26.06	.67	30.33	28
121	5	18.41	23.71	1.01	28.81	28
122	5	20.83	31.39	.96	29.53	24
123	5	19.16	24.82	.75	24.16	21
124	5	20.60	33.45	.79	30.21	16
125	5	21.82	26.94	1.10	24.96	24
126	5	20.96	24.00	.88	29.42	20
127	5	22.35	25.30	.80	23.86	23
128	5	21.26	32.04	.75	32.65	17
129	5	19.51	21.38	.75	28.30	16
130	5	19.47	26.77	.94	24.04	16
131	5	21.11	30.55	.74	30.65	33
132	5	18.95	26.17	.57	28.00	23
133	6	20.59	30.91	.75	32.72	29
134	6	18.50	22.88	.96	28.12	06
135	6	19.38	25.55	.96	26.86	17
136	6	21.92	26.23	.88	25.81	25
137	6	19.38	24.96	1.14	27.54	21
138	6	21.78	30.45	.68	27.85	31
139	6	20.19	29.39	.77	30.84	27

Mean Scores -- (Cont'd.)

Subject	Class	#16 Volleyball Chest Pass	#17 Volleyball Overhead Pass	#18 Hockey Drive	#19 Basketball Underarm Pass	#20 Wall Volley
141	6	19.03	25.35	.97	27.10	24
142	6	23.85	30.08	.85	27.07	34
143	6	23.61	26.58	.78	30.06	23
144	6	19.98	27.22	.99	26.10	27
145	6	24.02	25.88	.93	35.36	26
146	6	19.56	23.93	.81	26.04	14
147	6	20.83	28.06	.76	29.11	25
148	6	19.77	27.10	.87	28.12	20
149	6	18.73	33.87	.74	27.98	22
150	6	20.76	27.59	.76	28.26	22
151	6	21.12	26.59	.89	29.68	36
152	6	19.88	25.59	.93	24.38	21
153	6	20.51	24.51	.91	27.37	18
154	6	22.66	38.82	.81	29.84	31
155	6	23.85	32.32	.86	27.51	23
156	6	19.83	22.07	1.11	28.65	27
157	6	20.13	28.76	.90	32.35	12
158	6	21.18	26.70	1.12	26.79	15
159	6	19.98	23.27	.67	25.25	12
160	6	20.40	28.06	1.06	25.16	22
161	6	20.15	33.02	.95	29.46	26
162	6	20.38	27.41	.82	31.57	22
163	6	19.05	25.49	.89	27.21	14
164	6	22.64	23.71	1.07	27.79	21
165	6	20.86	26.54	.91	26.00	24
166	6	19.92	26.68	.62	28.41	14
167	6	21.03	36.42	1.01	30.69	32

Mean Scores -- (Cont-d)

Subject	Class	# 21 Bounce Dribble	# 22 Basketball Throw and Catch	# 23 Soccer Place-kick	# 24 Soccer Punt	# 25 Soccer Pass
001	1	28	22	38.89	39.13	33.08
002	1	19	17	37.11	38.15	39.63
003	1	16	17	35.49	33.83	40.82
004	1	26	18	37.56	38.61	35.45
005	1	21	22	36.83	32.88	40.59
006	1	19	19	40.19	40.15	36.18
007	1	22	21	40.85	37.36	39.29
008	1	20	19	36.45	34.06	41.50
009	1	23	23	49.30	50.63	43.68
010	1	16	21	39.37	36.90	32.32
011	1	32	17	35.66	32.94	33.53
012	1	19	22	35.75	41.78	34.31
013	1	21	18	40.05	34.46	30.82
014	1	18	21	35.91	35.61	31.17
015	1	26	18	35.68	29.42	24.33
016	1	17	16	41.50	43.26	44.61
017	1	22	19	37.86	45.16	31.53
018	1	22	18	33.41	33.52	34.04
019	1	23	19	36.79	37.12	30.29
020	1	19	20	39.51	42.46	40.39
021	1	16	16	39.77	27.89	25.61
022	1	20	19	40.72	33.73	32.55
023	1	25	19	34.93	32.43	35.56
024	1	29	16	37.54	32.12	38.65
025	1	21	16	38.95	47.07	34.10
026	1	24	23	37.25	44.52	32.36
027	1	21	20	42.87	36.88	41.47
028	1	19	19	28.78	42.77	36.67
029	1	22	19	40.89	38.55	31.27
030	1	18	19	34.94	33.10	35.38
031	1	18	19	37.82	41.44	38.77
032	1	22	20	42.45	39.79	46.25
033	1	24	20	40.39	37.52	40.17
034	2	25	22	33.86	39.99	42.13
035	2	13	19	40.13	32.65	39.45

Mean Scores -- (Cont'd.)

Subject	Class	# 21 Bounce Dribble	# 22 Basketball Throw and Catch	# 23 Soccer Place-kick	# 24 Soccer Punt	# 25 Soccer Pass
036	2	22	16	29.31	29.82	34.60
037	2	24	20	29.10	34.87	37.16
038	2	16	18	41.40	41.53	37.78
039	2	16	19	39.40	48.10	42.70
040	2	21	20	34.80	32.37	33.11
041	2	16	19	38.34	32.68	41.35
042	2	24	22	33.76	30.14	51.59
043	2	21	20	36.60	32.38	37.39
044	2	21	19	40.86	35.97	36.01
045	2	22	18	35.04	27.72	33.11
046	2	19	20	35.33	36.81	42.37
047	2	21	18	37.89	35.88	34.82
048	2	18	18	36.46	29.49	36.14
049	2	17	18	47.36	32.19	42.43
050	2	18	19	33.49	28.78	32.24
051	2	19	18	37.12	30.44	21.19
052	2	14	19	33.63	32.58	21.42
053	2	19	17	35.07	32.12	19.76
054	2	21	20	35.47	34.34	36.57
055	2	20	23	35.61	47.52	36.86
056	2	18	19	35.48	30.31	31.36
057	2	23	18	34.94	31.77	29.90
058	2	18	19	38.68	40.23	29.65
059	2	16	15	38.75	33.26	30.91
060	2	16	18	36.74	32.97	35.72
061	2	19	22	38.67	32.00	44.94
062	2	19	20	33.67	32.43	29.14
063	2	13	18	37.33	32.85	36.65
064	2	14	15	36.79	33.12	43.28
065	2	20	19	33.44	30.23	27.78
066	2	18	18	37.61	35.83	36.18
067	2	17	19	35.37	33.80	40.48
068	4	19	22	41.53	46.38	34.72
069	4	13	21	34.74	38.48	27.65
070	4	17	20	38.62	32.69	27.87

Mean Scores -- (Cont'd.)

Subject	Class	#21 Bounce Dribble	#22 Basketball Throw and Catch	#23 Soccer Place-kick	#24 Soccer Punt	#25 Soccer Pass
071	4	15	19	36.79	39.77	39.93
072	4	16	18	40.19	37.00	28.93
073	4	17	18	36.44	35.17	28.11
074	4	15	16	43.43	38.88	36.45
075	4	17	19	40.17	43.80	42.04
076	4	15	18	37.09	28.99	29.16
077	4	17	20	42.03	45.70	44.57
078	4	14	19	34.20	33.94	28.11
079	4	20	20	35.30	34.04	40.07
080	4	15	20	41.11	44.94	29.63
081	4	18	20	34.39	31.33	36.74
082	4	22	25	36.12	36.51	41.50
083	4	18	21	41.45	45.61	36.65
084	4	22	21	36.71	30.30	29.72
085	4	17	20	32.89	32.72	38.47
086	4	14	21	40.28	39.17	25.85
087	4	15	19	33.81	38.33	41.97
088	4	22	16	42.87	43.25	38.98
089	4	15	17	37.83	30.44	26.60
090	4	20	19	43.29	40.67	38.17
091	4	19	18	36.65	32.15	17.78
092	4	18	20	36.61	44.32	41.24
093	4	16	18	40.77	28.39	39.92
094	4	20	20	40.82	29.80	34.40
095	4	14	15	41.77	33.12	27.62
096	4	23	20	41.08	34.83	41.64
097	4	18	20	38.82	41.67	47.51
098	4	17	21	38.45	35.71	42.35
099	4	22	22	41.03	45.08	39.79
100	4.	19	21	38.24	39.23	36.13
101	4	19	22	36.11	43.05	35.28
102	5	17	18	38.36	32.62	49.93
103	5	23	20	43.27	37.04	32.23
104	5	17	18	36.52	36.26	42.80
105	5	15	21	39.33	35.62	31.38

Mean Scores -- (Cont'd.)

Subject	Class	# 21 Bounce Dribble	# 22 Basketball Throw and Catch	# 23 Soccer Place-kick	# 24 Soccer Punt	# 25 Soccer Pass
106	5	15	16	30.37	30.42	22.68
107	5	20.	20	44.68	42.04	39.29
108	5	19	19	42.78	43.35	35.17
109	5	14	18	37.60	34.87	35.54
110	5	20	18	43.66	37.69	38.08
111	5	22	23	41.74	44.84	46.90
112	5	15	21	38.32	39.50	33.40
113	5	17	17	38.02	29.89	38.70
114	5	17	19	41.43	41.61	47.03
115	5	16	19	36.71	35.57	27.52
116	5	17	18	37.27	37.43	36.01
117	5	11	18	32.50	31.58	31.02
118	5	20	21	35.16	31.57	38.30
119	5	18	20	37.95	37.22	43.12
120	5	17	20	39.05	45.70	38.86
121	5	20	19	35.79	29.61	39.52
122	5	13	18	40.78	40.10	40.46
123	5	20	20	36.93	34.17	39.53
124	5	19	21	40.81	33.62	42.51
125	5	16	21	39.04	38.67	36.68
126	5	20	18	41.25	26.50	35.09
127	5	17	20	36.46	32.77	35.31
128	5	23	23	37.77	36.93	42.34
129	5	21	18	37.97	34.68	35.13
130	5	21	19	36.59	30.82	42.70
131	5	23	22	38.93	37.41	39.72
132	5	23	18	44.31	37.24	32.03
133	5	22	25	43.45	35.21	45.67
134	6	28	17	39.45	30.39	40.00
135	6	13	19	36.30	33.06	32.59
136	6	28	22	38.64	33.61	39.81
137	6	16	18	36.52	32.54	46.97
138	6	20	21	39.62	43.52	36.73
139	6	23	20	43.94	43.77	39.77

Mean Scores -- (Cont'd.)

Subject	Class	# 21 Bounce Dribble	# 22 Basketball Throw and Catch	# 23 Soccer Place-kick	# 24 Soccer Punt	# 25 Soccer Pass
141	6	21	17	35.90	29.53	37.43
142	6	26	22	41.55	39.69	38.49
143	6	19	20	40.71	38.97	39.70
144	6	15	19	36.99	31.18	33.12
145	6	21	21	34.61	27.38	29.61
146	6	18	20	40.18	38.65	37.87
147	6	20	19	40.70	33.47	51.28
148	6	15	19	38.25	33.43	31.68
149	6	23	18	40.42	40.97	40.10
150	6	16	21	38.82	40.75	43.22
151	6	22	21	44.50	36.79	41.16
152	6	18	19	40.61	31.56	25.04
153	6	13	17	44.19	36.12	40.54
154	6	16	21	51.07	42.29	39.87
155	6	25	20	51.02	43.33	42.52
156	6	21	19	41.85	29.00	29.00
157	6	19	20	41.33	41.42	32.42
158	6	14	17	37.19	38.16	37.84
159	6	18	20	38.33	35.55	40.10
160	6	17	19	35.33	31.08	34.77
161	6	13	19	42.07	30.11	32.43
162	6	17	19	35.93	29.95	39.85
163	6	16	17	34.97	30.11	29.84
164	6	18	21	38.84	41.49	42.37
165	6	20	21	41.88	40.66	36.02
166	6	19	18	50.96	30.97	34.34
167	6	21	22	38.07	36.19	44.73

APPENDIX C

Pattern Matrices

and

Factor Intercorrelations (Four Models)

TABLE IV

ALPHA INITIAL SOLUTION

Derived Orthogonal Factor Matrix**

Variable	I	II	III	IV	V	VI	VII	h^2
1. Softball Overarm Throw	444	084	190	308	342	116	311	562
2. Basketball Overarm Throw	208	296	249	117	416	177	340	526
3. Volleyball Overarm Serve	077	-001	381	465	154	016	140	411
4. Tennis Serve	556	109	115	213	404	-073	-014	548
5. Badminton Clear	432	077	-029	277	492	116	080	532
6. Bowling	619	-032	122	-053	175	029	251	497
7. Softball Underarm Throw	360	-089	235	176	228	108	099	297
8. Volleyball Underarm Serve	568	187	080	065	276	220	073	499
9. Badminton Serve	652	108	050	064	-012	011	192	481
10. Tennis Drive	484	151	185	263	087	087	254	440
11. Volleyball Sidearm Serve	450	196	133	-011	226	151	116	346
12. Basketball One-Hand Push Pass	170	287	149	018	157	554	064	469
13. Basketball One-Hand Push Shot	173	517	224	074	186	068	002	392
14. Basketball Two-Hand Chest Pass	115	004	-037	095	094	782	042	645
15. Basketball Overhead Pass	149	101	209	-065	568	099	066	417
16. Volleyball Chest Pass	115	543	-050	129	044	089	202	378
17. Volleyball Overhead Pass	074	299	103	165	543	130	215	490
18. Hockey Drive	407	090	234	114	001	131	062	262
19. Basketball Underarm Pass	049	176	464	102	176	101	032	301
20. Wall Volley	277	181	051	016	194	089	664	599
21. Bounce-Dribble	198	-021	441	003	057	-054	146	261
22. Basketball Throw and Catch	263	108	234	071	118	005	611	527
23. Soccer Place-Kick	180	233	034	688	068	083	-020	573
24. Soccer Punt	563	232	-077	336	151	177	172	573
25. Soccer Pass	178	-085	067	244	367	053	255	305

** Decimal points omitted

TABLE V

ALPHA INITIAL SOLUTION

Derived Oblique Independent Cluster Factor Pattern**

Variable	I	II	III	IV	V	VI	VII
1. Softball Overarm Throw	256	026	068	189	233	207	-111
2. Basketball Overarm Throw	-094	047	144	-022	392	281	159
3. Volleyball Overarm Serve	-214	-015	421	448	040	066	-155
4. Tennis Serve	598	-217	-030	096	418	-260	-024
5. Badminton Clear	346	009	-212	164	565	-104	-105
6. Bowling	721	-037	011	-217	015	144	-121
7. Softball Underarm Throw	297	074	207	057	135	-040	-208
8. Volleyball Underarm Serve	617	102	-046	-068	183	-111	095
9. Badminton Serve	813	-071	-061	-008	-254	100	040
10. Tennis Drive	418	003	105	204	-138	174	023
11. Volleyball Sidearm Serve	466	041	039	-138	136	-019	134
12. Basketball One-Hand Push Pass	027	492	137	-074	050	-020	249
13. Basketball One-Hand Push Shot	068	-110	176	039	149	-119	504
14. Basketball Two-Hand Chest Pass	-018	838	-036	023	-014	-001	-069
15. Basketball Overhead Pass	-018	-012	125	-260	731	-094	012
16. Volleyball Chest Pass	-016	-050	-168	172	-028	236	507
17. Volleyball Overhead Pass	-246	-007	-039	054	681	136	154
18. Hockey Drive	441	075	234	049	-210	-054	041
19. Basketball Underarm Pass	-155	020	539	016	100	-082	138
20. Wall Volley	035	023	-109	-098	049	791	039
21. Bounce-Dribble	120	-092	509	-104	-100	077	-053
22. Basketball Throw and Catch	019	-047	151	-037	-087	710	-024
23. Soccer Place-Kick	-003	008	-028	803	-030	-120	068
24. Soccer Punt	560	074	-249	311	-003	065	081
25. Soccer Pass	-036	026	-037	148	401	211	-261

** Decimal points omitted

TABLE VI

FACTOR INTERCORRELATIONS, ALPHA INITIAL SOLUTION

Derived Independent Cluster Solution

	I	II	III	IV	V	VI	VII
Factor I	1.000	-.372	-.567	.534	-.664	-.649	.329
Factor II		1.000	.234	-.286	.405	.263	-.359
Factor III			1.000	-.437	.595	.528	-.269
Factor IV				1.000	-.533	-.430	.306
Factor V					1.000	.609	-.388
Factor VI						1.000	-.334
Factor VII							1.000

TABLE VII

ALPHA INITIAL SOLUTION

Derived Winsorized Factor Pattern **

Variable	I	II	III	IV	V	VI	VII
1. Softball Overarm Throw	313	-184	077	199	278	013	208
2. Basketball Overarm Throw	-064	119	089	-013	403	070	330
3. Volleyball Overarm Serve	-140	-199	450	479	060	-022	086
4. Tennis Serve	667	-065	-036	029	414	-260	-218
5. Badminton Clear	406	-196	-218	093	606	-024	-052
6. Bowling	741	-158	015	-180	032	-055	093
7. Softball Underarm Throw	351	-278	213	080	146	059	-038
8. Volleyball Underarm Serve	658	031	-076	-098	163	103	-101
9. Badminton Serve	836	026	-036	007	-253	-081	026
10. Tennis Drive	463	-013	126	226	-126	004	135
11. Volleyball Sidearm Serve	493	100	002	-146	111	049	-011
12. Basketball One-Hand Push Pass	047	166	067	-069	000	556	014
13. Basketball One-Hand Push Shot	100	532	107	-009	073	-077	-054
14. Basketball Two-Hand Chest Pass	-002	-231	-067	041	-015	897	004
15. Basketball Overhead Pass	015	-037	046	-288	722	-018	005
16. Volleyball Chest Pass	-020	538	-200	129	-043	-011	248
17. Volleyball Overhead Pass	-213	108	-099	005	704	-000	232
18. Hockey Drive	481	011	235	075	-243	085	-083
19. Basketball Underarm Pass	-107	128	489	046	042	047	-028
20. Wall Volley	014	022	-112	-026	130	042	736
21. Bounce-Dribble	152	-046	498	-028	-127	-088	064
22. Basketball Throw and Catch	017	-028	160	062	-024	-033	649
23. Soccer Place-Kick	078	017	025	732	-011	-000	-098
24. Soccer Punt	605	017	-224	266	023	067	039
25. Soccer Pass	000	-334	-023	152	476	000	230

** Decimal points omitted

TABLE VIII

FACTOR INTERCORRELATIONS, ALPHA INITIAL SOLUTION

Derived Winsorized Solution

	I	II	III	IV	V	VI	VIII
Factor I	1.000	.449	.492	.435	.634	.440	.617
Factor II		1.000	.377	.419	.572	.487	.290
Factor III			1.000	.221	.592	.275	.400
Factor IV				1.000	.493	.308	.202
Factor V					1.000	.503	.394
Factor VI						1.000	.228
Factor VII							1.000

TABLE IX

MODEL D INITIAL SOLUTION

Derived Orthogonal Factor Matrix**

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	h^2
1. SB Overarm Throw	314	115	359	251	315	079	106	326	-243	-016	134	179	063	641
2. BB Overarm Throw	153	295	350	350	141	190	204	159	-286	-007	137	034	-025	581
3. VB Overarm Serve	028	040	130	126	497	266	030	089	039	-002	094	070	041	379
4. Tennis Serve	613	092	073	329	244	134	-006	077	-152	007	-020	091	024	614
5. Badminton Clear	424	044	140	414	310	-045	148	165	-112	076	087	-020	095	555
6. Bowling	473	002	249	122	-048	139	034	370	057	-076	226	-015	091	529
7. SB Underarm Throw	275	-078	136	183	186	163	102	208	-008	-017	054	339	-002	367
8. VB Underarm Serve	585	181	103	227	081	143	296	098	030	-217	-002	086	-016	617
9. Badminton Serve	610	103	243	-053	060	098	065	195	009	107	059	-033	-019	516
10. Tennis Drive	358	163	284	082	310	139	099	253	261	-015	067	043	-002	506
11. VB Sidearm Serve	247	205	117	255	015	049	131	461	115	-045	118	037	044	446
12. BB One-Hand Push Pass	141	208	115	183	069	123	622	051	029	061	-064	-068	-012	533
13. BB One-Hand Push Shot	116	468	033	203	109	159	094	159	-017	066	-027	030	050	355
14. BB Two-Hand ChestPass	066	050	028	054	072	-050	617	106	-030	-043	085	082	010	426
15. BB Overhead Pass	142	093	095	556	017	178	129	044	040	038	094	014	-020	410
16. VB Chest Pass	108	509	190	038	114	-040	123	027	008	-050	010	-046	-034	345
17. VB Overhead Pass	037	295	238	497	203	028	124	091	-051	-213	059	152	019	532
18. Hockey Drive	196	087	101	-001	154	137	115	481	-075	030	-027	057	-038	355
19. BB Underarm Pass	-024	188	048	188	152	375	110	123	-079	107	015	104	034	294
20. Wall Volley	214	146	651	185	062	090	120	095	069	102	046	-045	028	580
21. Bounce-Dribble	157	-016	144	057	052	529	-027	067	025	-048	023	-006	-015	340
22. BB Throw and Catch	186	136	623	084	081	188	020	117	-058	089	089	115	-027	537
23. Soccer Place-Kick	205	222	-003	032	589	-009	107	043	-048	-009	033	008	-041	458
24. Soccer Punt	509	273	181	064	280	-046	203	171	098	-007	128	160	111	586
25. Soccer Pass	150	-012	192	253	247	060	065	072	-018	001	421	038	-004	376

** Decimal points omitted

TABLE X

MODEL D INITIAL SOLUTION

Derived Oblique Independent Cluster Factor Pattern** (13 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
1. Softball Overarm Throw	034	-033	174	053	160	-049	-019	185	325	017	059	189	067
2. Basketball Overarm Throw	103	170	188	088	-019	081	107	010	387	-004	103	-033	-031
3. Volleyball Overarm Serve	093	-037	050	100	471	243	-012	003	-048	-156	034	100	047
4. Tennis Serve	-084	014	-070	-045	113	037	-149	-060	129	422	384	105	020
5. Badminton Clear	-020	-067	007	075	173	-136	048	085	099	084	481	000	068
6. Bowling	-136	-064	137	170	-170	060	-063	445	-000	235	030	-016	081
7. Softball Underarm Throw	053	-132	-000	023	030	081	024	101	016	117	042	429	-005
8. Volleyball Underarm Serve	031	022	004	-029	-020	062	159	052	-035	650	054	025	-002
9. Badminton Serve	-394	064	194	005	014	-000	-025	136	018	277	075	015	-015
10. Tennis Drive	-048	060	267	035	272	065	005	260	-262	079	016	075	-019
11. Volleyball Sidearm Serve	080	134	-020	044	-099	-035	040	573	-057	026	081	024	-003
12. Basketball 1-Hand Push Pass	-020	105	077	-078	011	065	624	-024	-026	032	139	-068	-028
13. Basketball 1-Hand Push Shot	059	478	-072	-082	049	076	020	124	035	-014	096	-009	015
14. Basketball 2-Hand Chest Pass	031	-067	-071	075	014	-097	623	054	055	056	-113	080	024
15. Basketball Overhead Pass	200	067	004	131	-177	127	070	020	-054	016	474	008	-077
16. Volleyball Chest Pass	053	433	188	-025	131	-109	040	-010	028	112	-131	-157	-036
17. Volleyball Overhead Pass	467	133	144	047	051	-045	000	036	077	116	116	044	-004
18. Hockey Drive	-095	-005	-047	-148	129	066	061	494	168	-080	-073	101	-047
19. Basketball Underarm Pass	050	218	-083	-016	057	321	091	024	103	-181	088	139	013
20. Wall Volley	073	-022	737	013	-033	009	037	038	-019	069	012	-088	020
21. Bounce-Dribble	050	-029	094	007	-001	519	-054	026	-002	113	-013	012	-006
22. Basketball Throw and Catch	-086	073	634	042	-048	076	-050	-045	132	-107	-035	155	-032
23. Soccer Place-Kick	-008	089	-096	028	646	-048	025	-062	037	065	005	-020	-017
24. Soccer Punt	-110	163	084	106	217	-159	069	092	-085	310	-047	162	-106
25. Soccer Pass	043	-072	055	478	112	012	-000	024	045	-049	099	023	-004

** Decimal Points omitted

TABLE XI

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Independent Cluster Solution (13 Factors)

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Factor I	1.000	-.143	.043	.089	.037	.050	.124	-.035	-.135	.069	.118	-.009	-.004
Factor II		1.000	-.402	-.223	-.367	-.159	-.326	-.379	.325	.387	-.365	.252	.085
Factor III			1.000	.412	.364	.245	.274	.518	-.423	-.483	.436	-.405	-.015
Factor IV				1.000	.330	.146	.192	.392	-.316	-.358	.404	-.343	.016
Factor V					1.000	.136	.253	.391	-.331	-.428	.411	-.416	-.015
Factor VI						1.000	.083	.211	-.184	-.155	.222	-.218	.010
Factor VII							1.000	.299	-.231	-.332	.290	-.210	-.058
Factor VIII								1.000	-.375	-.552	.477	-.469	.013
Factor IX									1.000	.342	-.437	.371	-.035
Factor X										1.000	-.553	.447	.020
Factor XI											1.000	-.425	.022
Factor XII												1.000	-.006
Factor XIII													1.000

TABLE XII

MODEL D INITIAL SOLUTION

Derived Winsorized Factor Pattern** (13 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
1. Softball Overarm Throw	186	-005	-133	025	071	-272	243	180	-060	142	099	-130	474
2. Basketball Overarm Throw	231	064	100	-157	096	011	250	238	-314	-132	224	000	211
3. Volleyball Overarm Serve	074	003	088	-115	097	-073	-001	-013	429	026	070	-074	096
4. Tennis Serve	-012	-151	060	-090	008	025	-101	-064	-084	110	-089	156	851
5. Badminton Clear	-045	-049	-320	041	-009	096	031	-004	132	-058	008	-158	850
6. Bowling	-037	002	133	588	-001	-184	018	000	-019	-018	166	-027	179
7. Softball Underarm Throw	050	020	009	004	014	-023	039	-004	015	537	-022	015	028
8. Volleyball Underarm Serve	233	195	389	118	-156	-018	-205	-112	-090	055	-116	399	281
9. Badminton Serve	-413	-015	040	114	009	-021	183	020	-042	012	013	316	395
10. Tennis Drive	-073	-013	001	173	-024	095	145	011	443	060	-077	276	-083
11. Volleyball Sidearm Serve	110	-003	-089	472	128	086	-093	243	060	-002	039	022	-136
12. Basketball 1-Hand Push Pass	-115	613	018	-088	052	287	102	012	064	-118	-170	038	061
13. Basketball 1-Hand Push Shot	018	-025	-053	156	587	-005	-057	-054	006	-047	-090	120	060
14. Basketball 2-Hand Chest Pass	024	666	-030	023	-007	-044	-065	-006	-036	084	056	-002	-070
15. Basketball Overhead Pass	084	-015	-001	002	002	531	-002	002	-053	016	098	-046	039
16. Volleyball Chest Pass	148	001	006	-007	242	-067	116	-025	-018	-222	005	427	-094
17. Volleyball Overhead Pass	664	-040	007	010	-003	045	054	004	001	025	-000	037	-013
18. Hockey Drive	-014	001	021	022	-043	-004	-009	622	-001	005	-054	007	003
19. Basketball Underarm Pass	-049	067	115	-028	463	031	004	006	004	114	008	-141	-031
20. Wall Volley	224	064	023	135	-236	004	687	-065	160	-122	-114	-001	037
21. Bounce-Dribble	000	-028	588	018	005	021	006	027	025	-021	014	-001	-083
22. Basketball Throw and Catch	-079	-068	-051	-066	043	-017	761	-001	-046	172	045	042	-048
23. Soccer Place-Kick	046	-003	-021	-361	-010	-074	-184	142	303	-143	073	340	360
24. Soccer Punt	-110	009	-028	-084	-028	086	-003	046	036	197	141	669	-027
25. Soccer Pass	-006	002	003	050	-027	024	-007	-066	013	-001	602	061	-000

** Decimal points omitted

TABLE XIII

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Winsorized Solution (13 Factors)

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Factor I	1.000	.439	.183	-.261	.647	.645	.489	-.384	.395	.385	.564	.424	.576
Factor II		1.000	.118	-.285	.375	.381	.325	-.454	.248	.316	.330	.485	.423
Factor III			1.000	-.352	.467	.463	.549	-.450	.473	.529	.372	.138	.542
Factor IV				1.000	-.163	-.495	-.498	.552	-.173	-.472	-.327	-.556	-.583
Factor V					1.000	.570	.507	-.606	.476	.308	.423	.400	.534
Factor VI						1.000	.443	-.306	.287	.424	.476	.297	.647
Factor VII							1.000	-.529	.418	.406	.537	.493	.600
Factor VIII								1.000	-.560	-.631	-.464	-.518	-.661
Factor IX									1.000	.530	.628	.365	.538
Factor X										1.000	.568	.335	.699
Factor XI											1.000	.289	.656
Factor XII												1.000	.635
Factor XIII													1.000

TABLE XIV

MODEL D INITIAL SOLUTION

Derived Oblique Independent Cluster Factor Pattern** (12 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1. SB O'arm Throw	039	-053	164	045	159	-042	-019	171	382	016	066	150
2. BB O'arm Throw	102	196	177	093	-039	091	112	-015	386	-009	108	-033
3. VB O'arm Serve	097	-068	049	093	483	244	-014	007	-023	-143	032	075
4. Tennis Serve	-081	002	-071	-043	106	041	-148	-059	142	409	401	089
5. Badminton Clear	-015	-086	007	071	174	-136	049	094	124	080	489	-028
6. Bowling	-136	-089	136	152	-151	059	-066	473	032	224	028	-035
7. SB U'arm Throw	058	-169	-003	017	039	086	023	100	055	114	-045	410
8. VB U'arm Serve	027	030	006	-029	-020	059	159	063	-038	633	059	032
9. Badminton Serve	-398	074	185	001	011	002	-023	137	025	258	084	030
10. Tennis Drive	-052	054	261	024	286	062	005	275	-250	069	015	097
11. VB Sidearm Serve	079	124	-025	028	-088	-030	043	585	-037	010	078	037
12. BB 1-hand P.Pass	-020	111	076	-073	007	067	628	-027	-044	028	139	-054
13. BB 1-hand P.Shot	065	453	-084	-092	050	095	018	138	042	-030	116	-002
14. BB 2-hand C.Pass	033	-074	-070	072	016	-098	623	053	071	058	-117	069
15. BB O'head Pass	200	072	007	134	-181	131	076	029	-087	008	473	029
16. VB Chest Pass	049	465	174	-026	120	-101	040	-008	013	095	-118	-120
17. VB O'head Pass	468	136	140	046	048	-041	001	040	082	113	118	044
18. Hockey Drive	-101	011	-055	-150	123	068	069	453	196	-086	-081	110
19. BB U'arm Pass	059	177	-090	-022	060	338	090	024	116	-180	097	122
20. Wall Volley	069	-008	729	013	-027	004	036	047	-016	068	008	-086
21. Bounce-Dribble	-052	-041	096	008	005	523	-053	025	-011	117	-020	005
22. BB Throw & Catch	-086	077	618	042	-052	084	-050	-053	146	-111	-029	160
23. Soccer Place-Kick	-013	112	-101	029	635	-052	027	-082	045	064	-011	-010
24. Soccer Punt	-118	198	073	103	206	-159	071	086	-087	285	-038	212
25. Soccer Pass	042	-068	054	470	113	011	-001	038	048	-048	095	021

** Decimal points omitted

TABLE XV

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Independent Cluster Solution (13 Factors)

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Factor I	1,000	-.133	.037	.092	.031	.059	.121	-.040	-.121	.075	.116	.000
Factor II		1,000	-.391	-.200	-.353	-.158	-.332	-.358	.324	.370	-.356	.262
Factor III			1,000	.392	.356	.262	.272	.510	-.451	-.465	.435	-.408
Factor IV				1,000	.317	.150	.186	.369	-.334	-.333	.391	-.323
Factor V					1,000	.155	.252	.389	-.367	-.420	.418	-.424
Factor VI						1,000	.099	.230	-.219	-.169	.243	-.224
Factor VII							1,000	.301	-.246	-.329	.298	-.230
Factor VIII								1,000	-.420	-.544	.485	-.472
Factor IX									1,000	.377	-.475	.400
Factor X										1,000	-.554	.455
Factor XI											1,000	-.426
Factor XII												1,000

TABLE XVI

MODEL D INITIAL SOLUTION

Derived Winsorized Factor Matrix** (12 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1. SB Overarm Throw	045	-036	-105	148	-043	-051	210	289	292	173	039	006
2. BB O'arm Throw	043	082	074	-083	231	079	142	060	384	-056	119	-031
3. VB O'arm Serve	129	-006	199	562	-079	003	071	014	-101	021	062	-137
4. Tennis Serve	-149	-191	007	202	-035	403	-108	-083	224	113	-099	373
5. Badminton Clear	-087	-001	-288	376	-294	583	070	154	138	-142	-003	125
6. Bowling	-074	-050	131	-175	-097	-052	076	530	-034	-116	231	295
7. SB U'arm Throw	029	006	016	-016	-051	001	030	007	-020	625	-014	-001
8. VB U'arm Serve	053	142	261	-038	125	035	-079	-023	023	076	-051	649
9. Badminton Serve	-454	-023	-006	-014	087	114	153	106	010	067	026	096
10. Tennis Drive	-033	-007	033	312	076	065	300	195	-365	128	-008	-029
11. VB S'arm Serve	112	-006	-073	-117	129	110	-040	653	-171	-033	065	070
12. BB 1-Hand P.Pass	-107	591	029	081	023	395	126	-072	-035	-104	-158	-052
13. BB 1-Hand P.Shot	-001	-057	032	-011	535	211	-151	150	002	-017	-077	-107
14. BB 2-Hand C.Pass	014	617	-038	-029	-036	-045	-050	046	024	079	069	050
15. BB O'head Pass	074	011	-009	-077	-008	647	-005	-080	-035	025	093	-001
16. VB Chest Pass	025	001	-016	006	607	-110	113	-026	-005	-104	007	012
17. VB O'head Pass	482	-053	-012	052	197	072	153	022	074	083	-001	193
18. Hockey Drive	-032	055	006	096	-005	-111	-018	629	037	042	-146	-074
19. BB U'arm Pass	-006	056	232	030	232	168	-128	025	071	133	-019	-265
20. Wall Volley	094	054	020	031	-084	019	845	010	-035	-057	-066	013
21. Bounce-Dribble	-008	-016	602	010	-008	-054	018	-003	003	-031	020	110
22. BB Throw & Catch	-164	-042	-021	-127	142	-037	698	-130	087	351	022	-357
23. Soccer Place-Kick	-000	009	-027	683	144	-030	-118	-041	002	-080	012	057
24. Soccer Punt	-189	035	-124	075	410	-044	-020	-058	-154	395	142	087
25. Soccer Pass	-012	008	012	082	000	019	-028	-016	015	006	580	-036

** Decimal Points omitted

TABLE XVII

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Winsorized Solution (12 Factors)

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Factor I	1.000	.093	-.068	-.106	.010	.172	-.138	.201	.146	-.101	.087	-.388
Factor II		1.000	-.019	.268	.424	.295	.223	-.297	.216	.276	.199	.275
Factor III			1.000	.260	.175	.509	.377	-.442	.303	.454	.259	.001
Factor IV				1.000	.574	.432	.430	-.535	.480	.651	.517	.414
Factor V					1.000	.576	.604	-.555	.426	.391	.339	.485
Factor VI						1.000	.570	-.641	.535	.636	.599	.465
Factor VII							1.000	-.623	.447	.528	.608	.542
Factor VIII								1.000	-.480	-.762	-.539	-.507
Factor IX									1.000	.530	.446	.190
Factor X										1.000	.593	.553
Factor XI											1.000	.411
Factor XII												1.000

TABLE XVIII

MODEL D INITIAL SOLUTION

Derived Oblique Independent Cluster Factor Pattern** (11 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
1. Softball Overarm Throw	054	-064	143	055	131	-039	-016	129	474	043	097
2. BB Overarm Throw	117	207	157	106	-085	106	114	-057	380	-032	132
3. VB Overarm Serve	092	-089	044	092	490	246	-018	001	022	-134	019
4. Tennis Serve	-039	-020	-074	-033	081	062	-144	-066	142	467	404
5. Badminton Clear	008	-054	-001	085	137	-126	051	069	103	062	517
6. Bowling	-148	-071	144	155	-181	042	-062	452	028	196	068
7. SB Underarm Throw	105	-277	-010	012	109	119	024	142	216	262	-049
8. VB Underarm Serve	044	017	016	-032	-045	051	169	067	-068	649	074
9. Badminton Serve	-386	071	183	005	008	010	-023	143	053	317	109
10. Tennis Drive	-040	007	256	013	333	069	002	318	-180	120	-022
11. VB Sidearm Serve	091	087	-029	022	-073	-018	044	603	-012	012	055
12. BB One-Hand Push Pass	-013	114	075	-074	009	085	629	-019	-074	013	132
13. BB One-Hand Push Shot	096	399	-100	-095	066	136	014	166	067	007	074
14. BB Two-Hand Chest Pass	028	-078	-069	070	014	-104	630	046	099	057	-105
15. BB Overhead Pass	249	034	004	139	-149	178	073	070	-120	029	379
16. VB Chest Pass	056	462	157	-032	108	-098	041	002	-005	085	-101
17. VB Overhead Pass	499	108	124	044	043	-033	005	044	086	097	085
18. Hockey Drive	-110	-017	-062	-151	113	071	069	427	301	-066	-051
19. BB Underarm Pass	082	111	-101	-021	090	383	084	040	174	-123	031
20. Wall Volley	065	027	717	013	-041	-012	037	035	-038	017	033
21. Bounce-Dribble	-063	-056	107	009	-004	526	-057	014	-030	115	-029
22. BB Throw and Catch	-058	037	593	045	-011	111	-054	-036	241	-033	-073
23. Soccer Place-Kick	-017	120	-111	029	606	-063	029	-102	065	068	059
24. Soccer Punt	-076	122	061	094	260	-137	075	143	016	413	-086
25. Soccer Pass	050	-063	050	477	113	011	001	036	047	-048	081

** Decimal points omitted

TABLE XIX

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Independent Cluster Solution (11 Factors)

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Factor I	1.000	-.205	.144	.183	.133	.146	.194	.086	-.215	-.068	.226
Factor II		1.000	-.308	-.139	-.265	-.146	-.292	-.265	.276	.290	-.267
Factor III			1.000	.389	.336	.306	.268	.498	-.499	-.480	.413
Factor IV				1.000	.313	.196	.192	.368	-.389	-.357	.397
Factor V					1.000	.209	.253	.388	-.431	-.448	.394
Factor VI						1.000	.144	.285	-.309	-.253	.284
Factor VII							1.000	.311	-.281	-.343	.297
Factor VIII								1.000	-.493	-.578	.472
Factor IX									1.000	.480	-.507
Factor X										1.000	-.570
Factor XI											1.000

TABLE XX

MODEL D INITIAL SOLUTION

Derived Winsorized Factor Matrix** (11 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
1. Softball Overarm Throw	075	-050	-122	054	-072	039	252	415	226	167	045
2. BB Overarm Throw	023	074	057	-113	273	082	197	076	318	013	138
3. VB Overarm Serve	121	-012	242	501	-110	019	075	034	-072	-102	060
4. Tennis Serve	-038	-191	-027	081	-018	471	-095	-033	162	553	-097
5. Badminton Clear	-031	000	-316	152	-111	692	068	134	055	017	002
6. Bowling	-151	-069	-002	-345	-032	043	083	444	-111	190	271
7. SB Underarm Throw	215	015	118	031	-348	-080	026	293	036	468	-008
8. VB Underarm	084	133	104	-118	054	106	-059	-093	-034	768	-051
9. Badminton Serve	-430	-015	-008	-051	-146	132	139	108	026	258	042
10. Tennis Drive	007	-000	083	254	041	-007	255	200	-296	079	009
11. VB Sidearm Serve	094	-013	-075	-262	145	042	-063	660	-214	-006	087
12. BB One-Hand Push Pass	-097	610	046	073	087	362	115	-108	-010	-079	-181
13. BB One-Hand Push Shot	021	-049	141	-004	543	025	-164	184	014	-027	-073
14. BB Two-Hand Chest Pass	014	620	-073	-023	-097	-012	-033	070	022	100	073
15. BB Overhead Pass	191	028	067	-142	-002	504	-027	-051	-035	-002	117
16. VB Chest Pass	-009	002	-004	051	657	-218	117	-120	006	030	010
17. VB Overhead Pass	541	-064	-046	-007	121	024	178	033	019	221	-003
18. Hockey Drive	-085	042	012	-002	-011	-060	-013	731	-003	-025	-161
19. BB Underarm Pass	032	064	369	079	138	022	-123	160	112	-086	-015
20. Wall Volley	075	049	-059	-005	-013	073	851	-079	-036	-036	-088
21. Bounce-Dribble	-068	-027	554	003	-068	-034	039	-033	010	160	022
22. BB Throw and Catch	-071	-029	096	-001	043	-143	702	026	173	-019	024
23. Soccer Place-Kick	-017	004	-027	599	206	037	-107	-092	-006	079	007
24. Soccer Punt	-055	051	-038	122	264	-181	-004	038	-079	468	173
25. Soccer Pass	-004	005	018	018	004	-000	-011	-052	011	-043	659

** Decimal points omitted

TABLE XXI

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Winsorized Solution (11 Factors)

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Factor I	1.000	.280	.178	.128	.355	.333	.100	-.154	.367	-.081	.287
Factor II		1.000	.049	.203	.436	.278	.214	-.337	.034	.300	.235
Factor III			1.000	.138	.244	.511	.428	-.421	.130	.204	.293
Factor IV				1.000	.401	.373	.323	-.573	.204	.498	.544
Factor V					1.000	.623	.563	-.586	.075	.551	.416
Factor VI						1.000	.596	-.674	.135	.665	.685
Factor VII							1.000	-.645	.040	.624	.648
Factor VIII								1.000	-.169	-.698	-.670
Factor IX									1.000	-.090	.156
Factor X										1.000	.585
Factor XI											1.000

TABLE XXII

MODEL D INITIAL SOLUTION

Derived Oblique Independent Cluster Factor Pattern** (10 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Softball Overarm Throw	066	-065	163	067	137	-036	-014	107	483	073
2. Basketball Overarm Throw	127	174	227	177	-065	078	115	-060	359	-006
3. Volleyball Overarm Serve	090	-086	034	063	509	255	-023	-016	039	-141
4. Tennis Serve	-048	012	-092	234	074	056	-144	-075	159	617
5. Badminton Clear	-013	-032	-044	436	143	-115	042	049	155	205
6. Bowling	-132	-104	176	113	-143	-025	-057	506	034	168
7. Softball Underarm Throw	118	-267	-013	-088	107	129	031	144	216	251
8. Volleyball Underarm Serve	058	010	025	-026	-034	036	181	106	-094	670
9. Badminton Serve	-378	058	206	034	026	-006	-018	167	050	355
10. Tennis Drive	-041	016	225	-041	350	082	003	331	163	096
11. Volleyball Sidearm Serve	088	100	-053	056	-067	-014	045	609	052	-005
12. Basketball One-Hand Push Pass	-030	142	045	084	-010	090	629	-041	-063	059
13. Basketball One-Hand Push Shot	088	419	-101	020	057	124	014	138	081	043
14. Basketball Two-Hand Chest Pass	042	-103	-045	-050	034	-106	639	058	085	-009
15. Basketball Overhead Pass	235	032	-005	413	-135	165	067	087	-100	105
16. Volleyball Chest Pass	068	431	200	-095	131	-119	046	010	-037	046
17. Volleyball Overhead Pass	501	103	126	095	050	-033	006	043	076	100
18. Hockey Drive	-119	042	-105	-152	076	094	070	374	349	-046
19. Basketball Underarm Pass	077	131	-090	036	079	374	082	009	187	-098
20. Wall Volley	062	027	713	036	-044	-006	036	048	-059	022
21. Bounce-Dribble	-060	-050	128	-020	-005	510	-055	028	-042	120
22. Basketball Throw and Catch	-046	015	642	-040	-003	101	-052	-028	207	049
23. Soccer Place-Kick	-014	112	-112	024	634	-059	028	-124	075	083
24. Soccer Punt	-047	068	111	-082	316	-156	087	190	-013	350
25. Soccer Pass	085	-185	165	340	226	-031	003	122	018	-141

** Decimal points omitted.

TABLE XXIII

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Independent Cluster Solution (10 Factors)

	I	II	III	IV	V	VI	VII	VIII	IX	X
Factor I	1.000	-.203	.188	.291	.173	.143	.209	.114	-.242	-.121
Factor II		1.000	-.257	-.193	-.238	-.115	-.275	-.217	.230	.255
Factor III			1.000	.416	.388	.273	.284	.520	-.498	-.489
Factor IV				1.000	.386	.240	.278	.429	-.485	-.512
Factor V					1.000	.195	.279	.426	-.465	-.493
Factor VI						1.000	.123	.247	-.279	-.230
Factor VII							1.000	.322	-.286	-.356
Factor VIII								1.000	-.495	-.591
Factor IX									1.000	.505
Factor X										1.000

TABLE XXIV

MODEL D INITIAL SOLUTION

Derived Winsorized Factor Matrix** (10 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Softball Overarm Throw	110	-046	-117	067	-151	076	462	369	-245	227
2. Basketball Overarm Throw	035	094	013	-046	151	080	557	153	-385	065
3. Volleyball Overarm Serve	077	-021	339	450	-103	136	-024	001	-004	-096
4. Tennis Serve	-007	-181	003	057	-006	129	-023	-017	-065	788
5. Badminton Clear	-125	014	-146	013	-020	548	008	034	-078	380
6. Bowling	-102	-072	-009	-411	-090	398	076	333	282	157
7. Softball Underarm Throw	309	037	099	031	-411	-050	020	264	038	297
8. Volleyball Underarm Serve	188	196	041	-115	-068	-079	-083	-047	273	648
9. Badminton Serve	-397	-005	-024	-052	098	058	210	077	129	453
10. Tennis Drive	-014	003	176	127	041	160	007	061	412	046
11. Volleyball Sidearm Serve	092	-015	-025	-384	129	387	-168	490	317	-091
12. Basketball One-Hand Push Pass	-169	702	140	000	111	056	037	-103	-028	021
13. Basketball One-Hand Push Shot	006	-053	133	-005	497	002	-051	190	-007	000
14. Basketball Two-Hand Chest Pass	034	712	-090	007	-232	-004	-017	106	002	-010
15. Basketball Overhead Pass	129	046	172	-269	062	542	-095	-076	017	058
16. Volleyball Chest Pass	001	007	-082	117	502	-197	272	-060	062	-007
17. Volleyball Overhead Pass	556	-050	-037	-046	047	087	209	030	-013	036
18. Hockey Drive	-071	041	049	-048	009	-023	001	592	000	-002
19. Basketball Underarm Pass	024	070	380	094	128	007	004	196	-207	-105
20. Wall Volley	043	068	014	-111	020	034	795	-165	044	-042
21. Bounce-Dribble	-025	-024	541	002	-057	-041	058	003	007	065
22. Basketball Throw and Catch	-049	-028	075	020	-009	-129	897	020	-204	-023
23. Soccer Place-Kick	-049	005	014	624	119	-025	-111	-068	011	224
24. Soccer Punt	023	077	-117	176	043	-036	039	058	300	594
25. Soccer Pass	-001	001	-003	051	-182	570	115	-007	030	-073

** Decimal points omitted

TABLE XXV

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Winsorized Solution (10 Factors)

	I	II	III	IV	V	VI	VII	VIII	IX	X
Factor I	1.000	.494	.208	.359	.624	.640	.345	-.274	-.049	.365
Factor II		1.000	.137	.301	.573	.463	.362	-.409	.204	.448
Factor III			1.000	.088	.187	.353	.448	-.366	.164	.433
Factor IV				1.000	.335	.561	.415	-.543	.333	.364
Factor V					1.000	.479	.381	-.378	.147	.466
Factor VI						1.000	.641	-.545	.237	.652
Factor VII							1.000	-.596	.617	.591
Factor VIII								1.000	-.448	-.606
Factor IX									1.000	.381
Factor X										1.000

TABLE XXVI

MODEL D INITIAL SOLUTION

Derived Oblique Independent Cluster Factor Pattern ** (9 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII	IX
1. Softball Overarm Throw	136	-065	165	037	163	-043	-007	159	423
2. Basketball Overarm Throw	088	140	224	195	-051	065	116	-048	378
3. Volleyball Overarm Serve	-121	-091	031	108	528	239	-030	-023	052
4. Tennis Serve	764	-008	-082	050	074	055	-119	-042	103
5. Badminton Clear	447	-108	-035	184	134	-126	047	051	177
6. Bowling	229	-125	186	-051	-156	030	-053	538	-004
7. Softball Underarm Throw	158	-212	-015	035	146	124	051	200	120
8. Volleyball Underarm Serve	576	057	030	052	-028	042	219	141	-181
9. Badminton Serve	474	034	225	-341	-011	015	-005	195	-008
10. Tennis Drive	048	031	231	-038	343	084	005	336	-192
11. Volleyball Sidearm Serve	-028	095	-053	135	-066	-019	042	633	035
12. Basketball One-Hand Push Pass	066	119	047	039	-023	089	641	-057	-032
13. Basketball One-Hand Push Shot	050	408	-104	117	053	118	011	138	096
14. Basketball Two-Hand Chest Pass	-088	-084	-046	-003	045	-105	656	074	060
15. Basketball Overhead Pass	217	-028	-009	470	-130	142	066	060	-023
16. Volleyball Chest Pass	-010	445	199	031	120	-116	046	-001	-031
17. Volleyball Overhead Pass	-001	133	113	522	094	-057	013	047	082
18. Hockey Drive	-064	058	-103	-211	082	099	071	429	275
19. Basketball Underarm Pass	-078	117	-096	103	094	361	078	014	204
20. Wall Volley	-006	027	717	098	-044	-006	036	039	-047
21. Bounce-Dribble	106	-047	128	-030	-001	507	-051	034	-053
22. Basketball Throw and Catch	-037	016	646	-071	003	103	-054	-014	191
23. Soccer Place-Kick	134	113	-109	-039	636	-062	032	-123	055
24. Soccer Punt	299	103	120	-102	313	-147	106	220	-091
25. Soccer Pass	004	-243	168	245	229	-048	-008	104	069

** Decimal Points omitted

TABLE XXVII

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Independent Cluster Solution (9 Factors)

	I	II	II	IV	V	VI	VII	VIII	IX
Factor I	1.000	.210	-.514	-.342	-.514	-.228	-.383	-.626	.446
Factor II		1.000	-.227	-.202	-.220	-.082	-.271	-.196	.173
Factor III			1.000	.327	.402	.257	.312	.543	-.449
Factor IV				1.000	.303	.188	.297	.286	-.398
Factor V					1.000	.184	.312	.451	-.420
Factor VI						1.000	.119	.242	-.240
Factor VII							1.000	.364	-.274
Factor VIII								1.000	-.431
Factor IX									1.000

TABLE XXVIII

MODEL D INITIAL SOLUTION

Derived Winsorized Factor Matrix** (9 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII	IX
1. Softball Overarm Throw	259	-037	-089	058	-089	-007	457	348	-233
2. Basketball Overarm Throw	152	086	002	-121	122	103	564	170	-375
3. Volleyball Overarm Serve	-111	-022	366	541	-067	098	-011	001	-012
4. Tennis Serve	907	-166	-006	006	012	-027	-024	-030	-038
5. Badminton Clear	563	013	-167	064	-112	182	059	055	-048
6. Bowling	178	-068	-008	-189	-173	044	095	378	307
7. Softball Underarm Throw	187	053	142	119	-235	056	-022	200	-031
8. Volleyball Underarm Serve	595	207	031	-038	029	053	-133	-082	-286
9. Badminton Serve	571	-002	-025	-063	-001	-413	229	104	-177
10. Tennis Drive	-000	006	183	352	017	029	007	094	424
11. Volleyball Sidearm Serve	-127	-020	-041	-126	046	298	-154	582	314
12. Basketball One-Hand Push Pass	073	677	112	-019	050	-022	050	-090	-016
13. Basketball One-Hand Push Shot	035	-064	099	-011	408	106	-045	287	-015
14. Basketball Two-Hand Chest Pass	-053	700	-085	027	-169	002	-026	062	002
15. Basketball Overhead Pass	127	036	132	-109	-021	535	-067	-033	018
16. Volleyball Chest Pass	002	003	-114	082	449	-003	257	-007	067
17. Volleyball Overhead Pass	-055	-043	-052	079	154	591	168	019	-035
18. Hockey Drive	-024	039	076	-017	001	-210	004	639	-001
19. Basketball Underarm Pass	-094	056	383	069	110	048	012	240	-221
20. Wall Volley	-058	070	012	-008	013	073	777	-185	069
21. Bounce-Dribble	035	-027	559	047	-045	-087	048	013	008
22. Basketball Throw and Catch	-013	-025	098	-005	002	-176	883	-004	-179
23. Soccer Place-Kick	282	009	021	582	138	-097	-099	-065	017
24. Soccer Punt	375	088	-115	263	081	-088	082	054	319
25. Soccer Pass	002	-002	-003	233	-240	310	161	-001	044

** Decimal points omitted

TABLE XXIX

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Winsorized Solution (9 Factors)

	I	II	III	IV	V	VI	VII	VIII	IX
Factor I	1.000	.456	.447	.430	.193	.636	.631	-.713	.416
Factor II		1.000	.149	.284	.423	.457	.363	-.472	.213
Factor III			1.000	-.021	.085	.360	.447	-.349	.262
Factor IV				1.000	.165	.341	.347	-.521	.013
Factor V					1.000	.240	.161	-.176	.068
Factor VI						1.000	.560	-.531	.125
Factor VII							1.000	-.637	.603
Factor VIII								1.000	-.371
Factor IX									1.000

TABLE XXX

MODEL D INITIAL SOLUTION

Derived Oblique Independent Cluster Factor Pattern** (8 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII
1. Softball Overarm Throw	-031	242	226	-123	247	-033	053	302
2. Basketball Overarm Throw	089	416	266	075	038	079	-001	072
3. Volleyball Overarm Serve	-014	087	050	-085	496	243	-111	-007
4. Tennis Serve	-143	143	-081	-042	124	062	721	-020
5. Badminton Clear	034	283	-022	-133	170	-123	414	081
6. Bowling	-049	-080	197	-108	-207	014	292	497
7. Softball Underarm Throw	050	065	007	-219	140	121	160	226
8. Volleyball Underarm Serve	216	-014	-001	078	-072	035	641	045
9. Badminton Serve	-024	-330	238	026	009	015	482	207
10. Tennis Drive	031	-179	226	079	241	074	154	245
11. Volleyball Sidearm Serve	053	130	-048	105	-124	-030	041	608
12. Basketball One-Hand Push Pass	629	046	037	115	-023	093	084	-066
13. Basketball One-Hand Push Shot	002	199	-102	377	074	128	038	179
14. Basketball Two-Hand Chest Pass	646	017	-039	-086	054	-104	-079	099
15. Basketball Overhead Pass	077	469	-031	-018	-180	134	253	-019
16. Volleyball Chest Pass	044	050	194	439	125	-107	002	-007
17. Volleyball Overhead Pass	027	568	107	133	065	-058	014	010
18. Hockey Drive	052	-091	-055	016	130	105	-097	559
19. Basketball Underarm Pass	067	209	-072	077	127	371	-121	099
20. Wall Volley	048	063	725	052	-093	-015	041	-029
21. Bounce-Dribble	-048	-069	131	-042	-038	503	131	012
22. Basketball Throw and Catch	-064	017	691	-006	033	106	-070	042
23. Soccer Place-Kick	030	-017	-097	100	660	-047	112	-075
24. Soccer Punt	109	-153	117	121	282	-147	352	182
25. Soccer Pass	009	236	182	-227	190	-055	027	079

** Decimal points omitted

TABLE XXXI

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Independent Cluster Solution (8 Factors)

	I	II	III	IV	V	VI	VII	VIII
Factor I	1.000	.329	-.302	.233	-.290	-.118	.370	-.349
Factor II		1.000	-.435	.156	-.402	-.244	.424	-.412
Factor III			1.000	-.167	.411	.268	-.531	.569
Factor IV				1.000	-.153	-.051	.148	-.136
Factor V					1.000	.195	-.498	.468
Factor VI						1.000	-.229	.259
Factor VII							1.000	-.634
Factor VIII								1.000

TABLE XXXII

MODEL D INITIAL SOLUTION

Derived Winsorized Factor Matrix** (8 Factors)

Variable	I	II	III	IV	V	VI	VII	VIII
1. Softball Overarm Throw	050	-069	294	122	-159	000	311	318
2. Basketball Overarm Throw	-113	054	411	-012	080	101	375	064
3. Volleyball Overarm Serve	-194	-016	032	540	-089	370	096	-036
4. Tennis Serve	839	-208	253	060	-035	040	-178	-102
5. Badminton Clear	484	-011	417	076	-174	-129	001	024
6. Bowling	408	-071	-043	-396	-152	-028	133	563
7. Softball Underarm Throw	177	046	093	074	-270	179	-001	227
8. Volleyball Underarm Serve	793	205	037	-150	037	-001	-130	-037
9. Badminton Serve	695	-020	-295	-094	-011	-017	073	165
10. Tennis Drive	255	026	-217	153	052	095	167	239
11. Volleyball Sidearm Serve	073	-015	076	-354	089	-094	-006	758
12. Basketball One-Hand Push Pass	081	690	-015	-001	037	140	017	-146
13. Basketball One-Hand Push Shot	-013	-080	072	-013	440	090	-067	253
14. Basketball Two-Hand Chest Pass	-049	720	014	027	-213	-053	-005	056
15. Basketball Overhead Pass	150	032	505	-209	-007	132	021	-034
16. Volleyball Chest Pass	028	002	-015	075	483	-168	222	-013
17. Volleyball Overhead Pass	-106	-046	598	004	162	-075	263	011
18. Hockey Drive	-066	024	-194	-032	-014	121	-048	688
19. Basketball Underarm Pass	-276	042	072	137	105	450	-026	147
20. Wall Volley	038	079	108	-109	032	-008	743	-108
21. Bounce-Dribble	055	-032	-171	015	-022	591	040	001
22. Basketball Throw and Catch	-108	-038	021	025	-013	153	714	-004
23. Soccer Place-Kick	184	003	-022	663	092	005	-090	-146
24. Soccer Punt	545	091	-118	164	076	-175	048	134
25. Soccer Pass	003	004	329	150	-272	-004	263	045

**Decimal points omitted

TABLE XXXIII

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Winsorized Solution (8 Factors)

	I	II	III	IV	V	VI	VII	VIII
Factor I	1.000	.458	.517	.536	.383	.516	.672	-.752
Factor II		1.000	.500	.366	.534	.223	.315	-.520
Factor III			1.000	.460	.447	.464	.324	-.580
Factor IV				1.000	.329	.171	.371	-.668
Factor V					1.000	.288	.311	-.394
Factor VI						1.000	.429	-.443
Factor VII							1.000	-.593
Factor VIII								1.000

TABLE XXXIV

MODEL D INITIAL SOLUTION

Derived Oblique Independent Cluster Factor Pattern** (7 Factors)

Variable	I	II	III	IV	V	VI	VII
1. Softball Overarm Throw	092	157	255	285	196	121	023
2. Basketball Overarm Throw	-029	406	313	000	041	112	105
3. Volleyball Overarm Serve	-182	059	020	067	414	343	-050
4. Tennis Serve	676	245	-161	048	124	051	-204
5. Badminton Clear	364	292	-071	244	150	-066	030
6. Bowling	501	-132	236	197	-236	139	024
7. Softball Underarm Throw	189	024	-037	233	052	250	053
8. Volleyball Underarm Serve	693	104	-043	-097	-035	-017	177
9. Badminton Serve	639	-277	222	-007	017	023	-035
10. Tennis Drive	285	-184	267	-012	240	144	055
11. Volleyball Sidearm Serve	273	033	118	084	-084	127	215
12. Basketball One-Hand Push Pass	086	118	020	-189	-005	037	595
13. Basketball One-Hand Push Shot	123	220	055	-291	176	138	076
14. Basketball Two-Hand Chest Pass	-053	-010	-060	106	028	-061	667
15. Basketball Overhead Pass	174	512	-051	-002	-187	126	055
16. Volleyball Chest Pass	063	097	331	-311	264	-187	090
17. Volleyball Overhead Pass	-064	559	177	006	110	-047	063
18. Hockey Drive	120	-201	065	100	110	299	177
19. Basketball Underarm Pass	-123	201	-026	-136	096	442	072
20. Wall Volley	062	086	723	-017	-094	-062	013
21. Bounce-Dribble	147	-014	080	-153	-116	522	-125
22. Basketball Throw and Catch	-039	005	693	024	-009	122	-093
23. Soccer Place-Kick	054	004	-099	-008	678	-016	014
24. Soccer Punt	460	-126	148	014	330	-121	137
25. Soccer Pass	031	178	134	309	114	042	006

** Decimal points omitted

TABLE XXXV

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Independent Cluster Solution (7 Factors)

	I	II	III	IV	V	VI	VII
Factor I	1.000	.443	-.570	-.365	-.497	-.460	-.424
Factor II		1.000	-.453	-.242	-.407	-.385	-.376
Factor III			1.000	.297	.413	.456	.366
Factor IV				1.000	.254	.278	.118
Factor V					1.000	.353	.341
Factor VI						1.000	.257
Factor VII							1.000

TABLE XXXVI

MODEL D INITIAL SOLUTION

Derived Winsorized Factor Matrix** (7 Factors)

Variable	I	II	III	IV	V	VI	VII
1. Softball Overarm Throw	135	021	366	339	-282	-001	239
2. Basketball Overarm Throw	-100	070	426	006	030	121	372
3. Volleyball Overarm Serve	-275	-018	082	524	-098	400	-022
4. Tennis Serve	754	-341	-203	091	-064	-011	447
5. Badminton Clear	462	-048	020	182	-205	-214	480
6. Bowling	610	012	164	-081	-254	-002	001
7. Softball Underarm Throw	214	066	002	226	-279	149	093
8. Volleyball Underarm Serve	762	056	-177	-143	141	-011	210
9. Badminton Serve	760	-098	020	040	-003	005	-170
10. Tennis Drive	314	036	150	280	022	189	-193
11. Volleyball Sidearm Serve	300	201	096	-024	-081	076	066
12. Basketball One-Hand Push Pass	021	571	-032	-135	292	149	-010
13. Basketball One-Hand Push Shot	015	004	-007	012	326	314	118
14. Basketball Two-Hand Chest Pass	-032	704	-025	043	005	-095	-064
15. Basketball Overhead Pass	115	-014	057	-235	-009	089	558
16. Volleyball Chest Pass	030	010	245	018	426	-009	006
17. Volleyball Overhead Pass	-119	-005	346	006	060	-054	570
18. Hockey Drive	115	221	008	262	-132	297	-239
19. Basketball Underarm Pass	-298	086	-002	117	085	571	048
20. Wall Volley	080	-007	727	-123	049	-070	071
21. Bounce-Dribble	018	-115	-011	037	027	629	-115
22. Basketball Throw and Catch	-057	-076	703	053	-044	126	-043
23. Soccer Place-Kick	063	-033	-115	625	089	068	000
24. Soccer Punt	573	062	028	280	072	-116	-044
25. Soccer Pass	014	018	286	252	-307	-105	268

** Decimal points omitted

TABLE XXXVII

FACTOR INTERCORRELATIONS, MODEL D INITIAL SOLUTION

Derived Winsorized Solution (7 Factors)

	I	II	III	IV	V	VI	VII
Factor I	1.000	.528	.684	.471	.197	.621	.425
Factor II		1.000	.389	.370	.271	.379	.554
Factor III			1.000	.367	.219	.563	.371
Factor IV				1.000	.458	.257	.496
Factor V					1.000	-.016	.293
Factor VI						1.000	.522
Factor VII							1.000

TABLE XXXVIII

JORESKOG INITIAL SOLUTION

Derived Orthogonal Factor Matrix**

Variable	I	II	III	IV	V	h^2
1. Softball Overarm Throw	422	107	317	425	331	579
2. Basketball Overarm Throw	195	279	346	519	172	534
3. Volleyball Overarm Serve	101	-006	151	266	439	297
4. Tennis Serve	603	050	-020	370	237	559
5. Badminton Clear	465	161	016	421	253	484
6. Bowling	610	047	287	158	-057	484
7. Softball Underarm Throw	383	025	101	278	166	263
8. Volleyball Underarm Serve	592	384	048	236	071	561
9. Badminton Serve	630	120	240	-037	112	482
10. Tennis Drive	454	192	310	086	308	441
11. Volleyball Sidearm Serve	399	246	189	241	039	315
12. Basketball One-Hand Push Pass	142	638	075	196	032	472
13. Basketball One-Hand Push Shot	123	301	125	251	203	226
14. Basketball Two-Hand Chest Pass	104	533	-025	103	040	308
15. Basketball Overhead Pass	193	177	056	530	-048	355
16. Volleyball Chest Pass	056	373	236	050	233	254
17. Volleyball Overhead Pass	085	269	191	547	197	454
18. Hockey Drive	333	127	178	094	184	202
19. Basketball Underarm Pass	033	122	135	339	163	176
20. Wall Volley	270	207	595	222	040	521
21. Bounce-Dribble	219	-068	232	194	003	144
22. Basketball Throw and Catch	247	056	616	214	125	504
23. Soccer Place-Kick	182	180	-030	104	606	444
24. Soccer Punt	531	329	159	064	360	549
25. Soccer Pass	228	013	170	337	207	237

** Decimal points omitted

TABLE XXXIX

INCOMPLETE PRINCIPAL COMPONENTS INITIAL SOLUTION

Derived Orthogonal Factor Maxtrix**

Variable	I	II	III	IV	V	VI	VII	h^2
1. Softball Overarm Throw	433	104	346	354	024	137	372	601
2. Basketball Overarm Throw	182	197	469	143	247	208	422	594
3. Volleyball Overarm Serve	018	005	121	657	-043	386	167	626
4. Tennis Serve	622	-125	440	252	077	068	-039	670
5. Badminton Clear	467	095	520	317	012	-094	071	611
6. Bowling	668	004	161	094	-108	109	300	594
7. Softball Underarm Throw	391	134	247	243	-264	254	091	433
8. Volleyball Underarm Serve	639	263	295	061	142	039	057	593
9. Badminton Serve	743	-007	-067	046	088	029	215	614
10. Tennis Drive	517	087	020	320	130	157	310	515
11. Volleyball Sidearm Serve	510	164	279	-085	175	139	118	435
12. Basketball One-Hand Push Pass	168	742	168	013	232	145	083	689
13. Basketball One-Hand Push Shot	195	046	263	070	648	271	-032	608
14. Basketball Two-Hand Chest Pass	107	871	072	099	-064	-060	044	795
15. Basketball Overhead Pass	144	089	741	-103	034	188	050	628
16. Volleyball Chest Pass	112	104	022	137	719	-109	277	648
17. Volleyball Overhead Pass	036	129	638	197	272	042	270	612
18. Hockey Drive	482	185	-105	147	056	352	043	428
19. Basketball Underarm Pass	-014	136	233	155	188	654	010	560
20. Wall Volley	260	099	175	009	138	018	762	708
21. Bounce-Dribble	204	-096	016	-014	-080	678	194	555
22. Basketball Throw and Catch	231	-004	086	075	071	212	760	690
23. Soccer Place-Kick	196	088	036	781	251	-028	-051	725
24. Soccer Punt	602	130	111	356	206	-117	183	627
25. Soccer Pass	125	045	426	364	-253	-058	355	524

TA

TEST INTE

Variable	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
# 1	1.000	549	336	466	517	-410	410	398	379	392	399	212
# 2		1.000	243	377	399	-299	230	381	264	270	304	352
# 3			1.000	216	265	-151	242	144	108	315	117	155
# 4				1.000	551	-378	361	542	427	344	281	196
# 5					1.000	-350	304	405	358	370	346	301
# 6						1.000	-278	-434	-456	-382	-429	-124
# 7							1.000	339	230	301	236	125
# 8								1.000	419	408	357	392
# 9									1.000	396	256	184
#10										1.000	386	239
#11											1.000	251
#12												1.000
#13												
#14												
#15												
#16												
#17												
#18												
#19												
#20												
#21												
#22												
#23												
#24												
#25												

* Decimal points omitted

TABLE XL

EST INTERCORRELATIONS

1	#12	#13	#14	#15	#16	#17	#18	#19	#20	#21	#22	#23	#24	#25
9	212	290	238	246	188	430	-362	237	430	191	457	330	451	349
4	352	318	209	369	317	466	-300	316	412	202	438	228	337	343
7	155	185	053	149	084	257	-167	237	199	253	191	343	242	256
1	196	257	051	323	140	304	-225	191	250	217	290	339	442	235
6	301	214	193	355	178	354	-232	155	302	016	251	323	381	344
9	-124	-158	-126	-206	-115	-174	313	-151	-396	-200	-299	-054	-359	-310
6	125	126	185	237	057	236	-274	199	210	176	275	142	328	231
7	392	261	283	267	225	372	-230	142	352	250	226	252	518	207
6	184	208	118	151	175	059	-294	086	342	207	332	188	479	173
6	239	249	146	205	218	274	-301	193	411	222	366	329	487	260
	251	295	176	282	205	312	-345	150	267	149	243	125	367	223
	1,000	276	478	275	217	212	-194	224	291	093	187	176	304	105
		1,000	098	230	329	313	-175	266	160	104	193	201	249	107
			1.000	114	133	192	-130	100	114	-020	066	157	233	151
				1.000	087	393	-103	220	266	191	168	069	219	270
					1.000	262	-096	104	280	043	201	250	315	075
						1.000	-155	243	387	071	264	227	302	266
							1.000	-164	-178	-160	-207	-228	-288	-080
								1.000	103	215	216	170	122	116
									1.000	185	550	144	305	232
										1.000	249	053	056	143
											1.000	098	340	271
												1.000	382	244
													1.000	295
														1.000